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ABSTRACT

This curriculum guide is a primary resource to help teachers organize, instruct, and evaluate an introductory level course in industrial technology education at the middle school/junior high school level in Missouri. The guide consists of an introductory section, five units of instruction, and a section of appendixes. The introductory section reports on the project that developed the guide and provides a course flowchart and suggested course layout. The five units of instruction cover the following topics: (1) overview of technology; (2) working with technology; (3) energy and power technology; (4) communication technology; and (5) materials and processing technology. Each unit is organized in one or more lesson plans that include scope; competencies; content outline coordinated with teacher plans and activities; suggested student activities; references, audiovisual aids, supplies, and equipment; evaluation methods; and references. Numerous appendixes provide information sheets, activities and worksheets, crossword puzzles, resources, a bibliography, and a glossary. (KC)

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INTRODUCTION TO INDUSTRIAL TECHNOLOGY

CURRICULUM GUIDE

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Missouri

Introduction to Industrial Technology Guide

Advisory Committee

Eldon Divine
Point Lookout

Mike Dyrenfurth
Columbia

Dan Eckard
Warrensburg

Greg Hales
Palmyra

Dwight Hart
Florissant

Willie Horsely
Kansas City

Dan Moppin
St. Joseph

Steve Murray
Leadwood

Field Test Site Coordinators

Don Campbell
Wellington

Sam Claggett
Lee's Summit

Dennis Costigan
Kingsville

Marvin Hiley
Gallatin

Harold Hohenfeldt
Boonville

John McGee
Hamilton

Dan McMillen
Plato

John Petsch
St. Louis

Sylvia Saddler
St. Louis

Ron Sorenson
Tuscumbia

Project Staff

Project Directors:
Bill Downs
Art Rosser

Project Consultants:
John Dennison
Jerome Richter
Roy Schache

Project Coordinator:
Charles Keseman

Research Assistants:
Tom Mellinger
Jamie Wehar

Project Monitor:
Steve Coffman

Secretary:
Cindy Bertalott

Missouri State Board of Education

Roseann Bentley
Dan L. Blackwell
Terry A. Bond
Thomas R. Davis

Susan D. Finke
Raymond F. McCallister, Jr.
Cynthia B. Thompson
Roger L. Tolliver

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Missouri Department of Elementary and Secondary Education
Division of Vocational and Adult Education

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Acknowledgments

This Guide represents the third step toward the realization of a dream of Missouri's Industrial Technology (Industrial Arts) Education profession. Through the Missouri Industrial Technology Education Association, teachers throughout the state envisioned that improved industrial technology education for Missouri youth was both desirable and possible. Therefore, individually and collectively they sought to implement their dream. Through the encouragement, leadership and hard work of these professionals, the first step was accomplished--a study to determine the direction for the future was completed under the leadership of Mike Dyrenfurth and Stephen Coffman. A summary of the study was published in 1986 in the document "To Build A Future."

Again under the leadership of Dr. Dyrenfurth and Mr. Coffman, the second step in the realization of the dream was completed with the development and publication of the Missouri Industrial Technology Education Guide in 1987. Advisory Committees, consisting of industrial technology teachers and other related personnel, were established for each of these first two significant projects. The entire profession is indebted to the leadership of the Association, to the Advisory Committees, to Dr. Dyrenfurth and to Mr. Coffman for providing guidance and direction in these efforts which led to the development of this third publication, the Missouri Introduction to Industrial Technology Guide.

The development team of the Missouri Introduction to Industrial Technology Guide is indebted to Delbert Lund and Steve Coffman of the Department of Elementary and Secondary Education for their leadership in requesting proposals, in providing the funding for the development of these materials, and in monitoring the project. Special thanks goes to Dean Art Rosser and Dr. Bill Downs for writing the proposal for funding and for providing consultation and encouragement throughout the project. The members of the Advisory Committee and the Field Test Coordinators, as listed on the frontispiece, have given many hours and continual input from the line of action--the classroom--as they read, evaluated, discussed, and tested the materials. Their willingness to meet periodically throughout the year was especially helpful. Jerry Richter, John Dennison, and Roy Schache deserve special recognition for their assistance in writing portions of the document, in critiquing the content outlines, and in their interaction with the teachers in their role as special consultants throughout the project. Many other colleagues at CMSU and throughout the state have been most helpful in their willingness to share ideas.

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Publishers of technology textbooks were extremely cooperative in providing copies of their books for use by the writers and by the teachers field testing the materials under preparation. Since this document involves the coordination of published mate-

rials, the previous efforts of all authors and publishers working in the field of industrial technology must be acknowledged in preparing these materials. The cooperation of the publishers has been outstanding and most helpful throughout the project. John Hutchinson and Delmar Publishers deserve special recognition for their efforts in providing the notebook covers for the final documents.

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To all of the above, and to many others who were not specifically mentioned, the project coordinator acknowledges his debt.

Charles E. Keseman
July 1988

Foreword

The purpose of this Introduction to Industrial Technology Guide is to provide a primary resource for organizing, instructing, and evaluating an introductory level course in industrial technology education at the middle school/junior high school level in Missouri. The Guide consists of an introductory section, five units of instruction, and a section of appendices.

This course is intended to be the first formal course in industrial technology. It may be preceded, however, by instruction in technology education/industrial technology education which is integrated with existing subjects in the elementary classroom. The course content is designed to be flexible enough to serve for either a one or two semester course or a year course. A suggested course layout is included in the introductory materials to provide one guide for the number of days which may be devoted to each of the five major units for either a semester course or a year course. Of course, the number of days allotted to each unit will vary among schools and teachers. The previous experience of the student, the community interests, the expertise of the instructor, and other factors will help to determine this allocation. Each instructor is reminded that instruction in industrial technology at the middle school/junior high school level is normally broad-based, emphasizing breadth rather than depth in the subject.

The Advisory Committee and the project staff agreed that this document should not be prescriptive, but should give individual teachers many ideas from which to choose. A prescriptive curriculum would attempt to establish a narrow set of competencies, content, and activities which all teachers must teach to the exclusion of all other equally-worthwhile, but unchosen, items of content. It was agreed that this document should give a number of alternatives from which teachers may select as they develop a course for that particular school. Upon completion of this Guide, it was evident that no teacher could possibly teach all of the competencies, content, or activities included in the document. Teachers must choose those competencies, content items, and activities which can best give broad exposure to their particular group of learners after considering all of the related factors.

The following assumptions were made in the development of this curriculum guide:

1. This course in technology education should include a large number of hands-on activities, possibly as much as 75% of the total class time.

2. In order to provide articulation at all levels of industrial technology, the content outline was developed to be appropriate for this course, for an exploration course at the beginning high school level, and for a course in a cluster area; all with only minimal changes. Therefore, not all items of the content outline are appropriate at all course levels and those which are appropriate will be treated to varying degrees of depth in each course.

3. The competencies are not listed in any particular sequence. Teachers may choose to teach them in any order. Many competencies are listed with two levels of attainment so that a teacher can maintain good balance in all levels of learning competencies. Teachers must thus choose the level appropriate for their students.

4. There are many ways to outline and classify the content of the subjects included in this document. It should not be assumed that the method used herein must be used to the exclusion of other alternatives. The teacher should select from or add to the content of this document to best meet the needs of his students.

5. The reader must beware of oversimplification which may occur in the attempt to outline course content. The outline cannot fully describe any subject and the teacher must apply this document to the student's level of understanding.

6. No single textbook is appropriate for all schools in the state; therefore, no specific reading assignments were included in the activities. Teachers may consult the last page in each lesson for potential reading assignments in the texts available to them. When students are encouraged to read several texts or references, they will likely encounter some conflicts of information. The teacher may use this in a positive manner as an opportunity for discussion, problem solving, and critical thinking.

7. Each teacher and school should have available for teacher and student use a library consisting of a number of textbooks, reference books, and special interest books related to industrial technology.

8. The activities chosen for any industrial technology course at this level should contain a maximum number of problem solving opportunities and student choices.

Missouri Introduction to Industrial Technology Curriculum Guide

Available from:

Instructional Materials Laboratory, 908 Woodson-Way
University of Missouri-Columbia, Columbia, Missouri 65211
Phone (314) 882-2883, in Missouri (800) 392-7217

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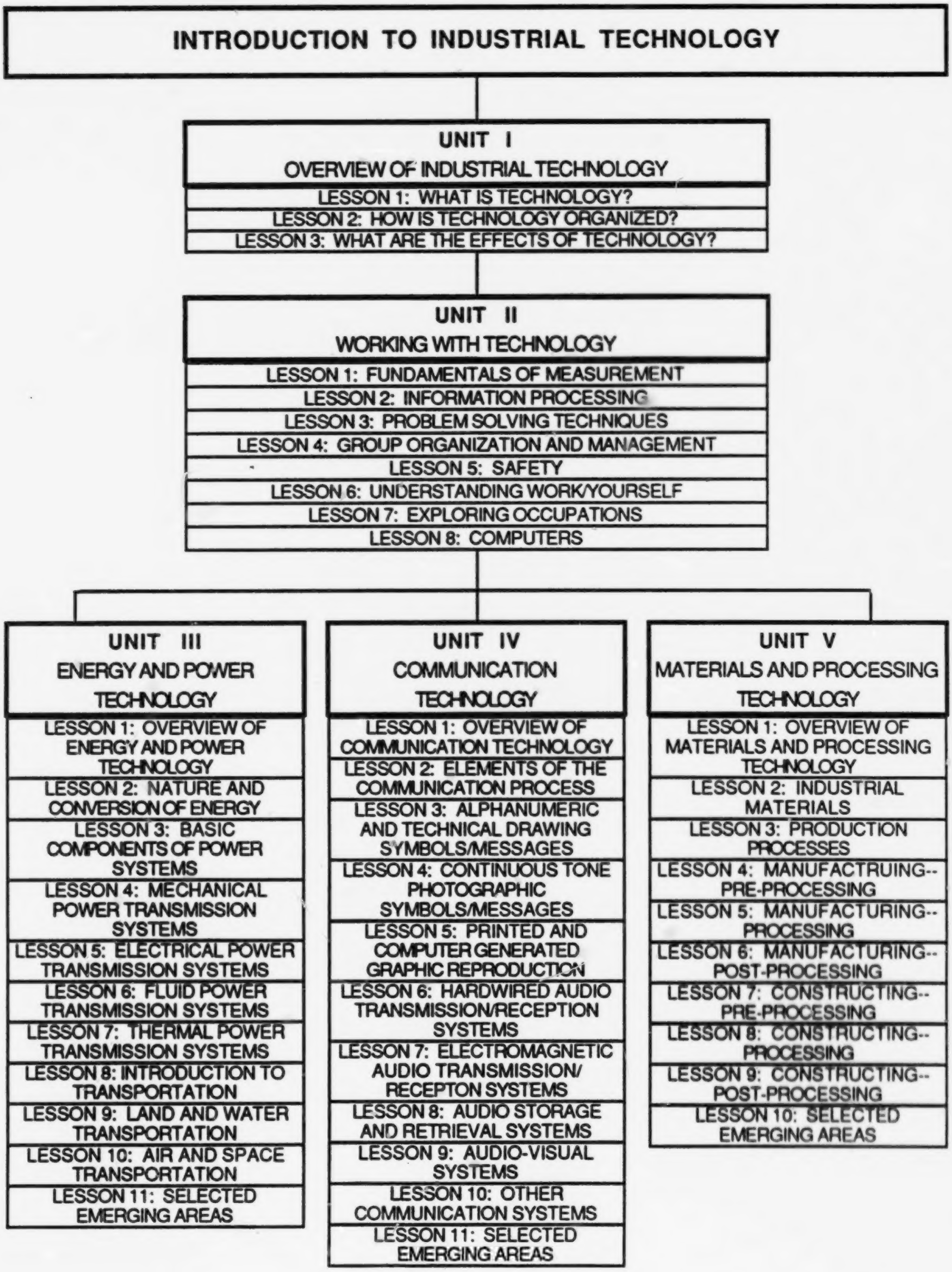

INTRODUCTION TO INDUSTRIAL TECHNOLOGY

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OVERVIEW OF INDUSTRIAL TECHNOLOGY

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- LESSON 6: FLUID POWER TRANSMISSION SYSTEMS
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- LESSON 5: PRINTED AND COMPUTER GENERATED GRAPHIC REPRODUCTION
- LESSON 6: HARDWIRED AUDIO TRANSMISSION/RECEPTION SYSTEMS
- LESSON 7: ELECTROMAGNETIC AUDIO TRANSMISSION/ RECEPTON SYSTEMS
- LESSON 8: AUDIO STORAGE AND RETRIEVAL SYSTEMS
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- LESSON 7: CONSTRUCTING--PRE-PROCESSING
- LESSON 8: CONSTRUCTING--PROCESSING
- LESSON 9: CONSTRUCTING--POST-PROCESSING
- LESSON 10: SELECTED EMERGING AREAS

Introduction To Industrial Technology: Flow Chart

SUGGESTED COURSE LAYOUT FOR INTRODUCTION TO INDUSTRIAL TECHNOLOGY

		Semester	Year
Unit I	Overview of Technology	(19)Days	(18)Days
I-1	What Is Technology?	5	5
I-2	How Is Technology Organized?	5	5
I-3	What Are the Effects of Technology?	6	6
	Locally Selected Emphasis	3	2
Unit II	Working With Technology	(26)Days	(35)Days
II-1	Fundamentals of Measurement	4	7
II-2	Information Processing	2	4
II-3	Problem Solving Techniques	6	8
II-4	Group Organization & Management	2	3
II-5	Safety	2	3
II-6	Understanding Work/Yourself	2	2
II-7	Exploring Occupations	2	2
II-8	Computers	3	5
	Locally Selected Emphasis	3	2
Unit III	Energy and Power Technology	Integrated (15)Days	(42)Days
III-1	Overview of Energy and Power Technology		3
III-2	Nature and Conversion of Energy		4
III-3	Basic Components of Power Systems		2
III-4	Mechanical Power Transmission Systems		4
III-5	Electrical Power Transmission Systems		4
III-6	Fluid Power Transmission Systems		4
III-7	Thermal Power Transmission Systems		3
III-8	Introduction to Transportation		2
III-9	Land and Water Transportation		5
III-10	Air and Space Transportation		5
III-11	Selected Emerging Areas in Energy and Power Technology		2
	Locally Selected Emphasis		4
Unit IV	Communication Technology	Integrated (15)Days	(42)Days
IV-1	Overview of Communication Technology		3
IV-2	Elements of the Communication Process		3
IV-3	Alphanumeric and Technical Drawing Symbols/Messages		4
IV-4	Continuous Tone Photographic Symbols/Messages		4
IV-5	Printed and Computer Generated Graphic Reproduction		4
IV-6	Hardwired Audio Transmission/Reception Systems		4
IV-7	Electromagnetic Audio Transmission/Reception Systems		4
IV-8	Audio Storage and Retrieval Systems		3
IV-9	Audio-Visual Systems		4
IV-10	Other Communication Systems		3
IV-11	Selected Emerging Areas in Communication Technology		2
	Locally Selected Emphasis		4

SUGGESTED COURSE LAYOUT FOR INTRODUCTION TO INDUSTRIAL TECHNOLOGY

		Semester Integrated	Year
Unit V	Materials & Processing Technology	(15)Days	(42)Days
V-1	Overview of Materials & Processing Technology		3
V-2	Industrial Materials		3
V-3	Production Processes		6
V-4	Manufacturing--Pre-Processing		2
V-5	Manufacturing--Processing		8
V-6	Manufacturing--Post-Processing		3
V-7	Constructing--Pre-Processing		3
V-8	Constructing--Processing		5
V-9	Constructing--Post-Processing		3
V-10	Selected Emerging Areas in Materials & Processing Technology		2
	Locally Selected Emphasis		4
Totals		90 Days	180 Days

UNIT I
OVERVIEW OF INDUSTRIAL TECHNOLOGY

LESSON 1
WHAT IS TECHNOLOGY?

- DEFINITIONS OF TECHNOLOGY
- PURPOSES OF TECHNOLOGY
- RESOURCES OF TECHNOLOGY
- COMPARISONS AND APPLICATIONS OF OTHER CURRICULAR AREAS

LESSON 2
HOW IS TECHNOLOGY ORGANIZED?

- THE SYSTEMS APPROACH
- SYSTEMS OF TECHNOLOGY

LESSON 3
WHAT ARE THE EFFECTS OF TECHNOLOGY?

- LEVELS OF COMPLEXITY IN TECHNOLOGICAL DEVELOPMENT
- TIMELINES OF TECHNOLOGY
- ASSESSMENT OF TECHNOLOGY
- TECHNIQUES OF FORECASTING FUTURE TECHNOLOGY

UNIT I: OVERVIEW OF TECHNOLOGY

I. Overview of Technology
  A. What Is Technology?
    1. Definitions of Technology
    2. Purposes of Technology
      a. Solve Problems
      b. Extend Human Potential
      c. Manage Environment
    3. Resources or Components of Technology
      a. Human
        (1) Principal Final Recipient of Products of Technology
        (2) Selected Aspects of Being Human
          (a) Stand Erect (Bipedal)
          (b) Rational Thought
          (c) Opposing Thumb
          (d) Clasp Objects
          (e) Stereoscopic Vision and Accurate Focusing
        (3) Sensory Perception
          (a) Sight
          (b) Hearing
          (c) Smell
          (d) Taste
          (e) Touch
      b. Tools and Machines
        (1) Extensions of Human Abilities
        (2) Have Subsystems
          (a) Support and Cover
          (b) Energy Transmission
          (c) Guidance and Control
        (3) Work as Converters of Materials, Energy and Information
        (4) Operate by Controlling Direction, Form and Intensity of Energy
      c. Materials
        (1) Nature
        (2) Characteristics
        (3) Function
      d. Materials Processes
        (1) Separating
        (2) Combining
        (3) Forming
        (4) Conditioning
      e. Energy
        (1) Source
        (2) Conversion Form
        (3) Transmission as Power
        (4) Output as Work
      f. Information
        (1) Converts Coded Patterns of Material or Energy Into Signals or Symbols With Assigned Meaning
        (2) Ideas Encoded as Signals or Symbols and Transmitted
        (3) Signals or Symbols Received and Decoded as Information
        (4) Measured, Counted or Stored

- g. Capital
  - (1) Means of Exchange
    - (a) Barter
    - (b) Money
    - (c) Stocks and Bonds
  - (2) Investments
    - (a) Equipment
    - (b) Facilities
    - (c) Land
- h. Time
  - (1) Human Limitations
  - (2) Natural Constraints
  - (3) Importance of Time
    - (a) Agriculture Age
    - (b) Industrial Age
    - (c) Information Age
- 4. Comparisons and Applications of Other Curricular Areas to Technology
  - a. Science
  - b. Mathematics
  - c. Social Studies/Civics
  - d. Language Arts/Reading/English
- B. How Is Technology Organized?
  - 1. The Systems Approach
    - a. Types of Systems
      - (1) Open Loop (no feedback)
      - (2) Closed Loop (includes feedback)
    - b. Elements of Systems
      - (1) Purpose
      - (2) Input
      - (3) Process
      - (4) Output
      - (5) Feedback
    - c. Analysis of Systems
      - (1) Supersystems
      - (2) Subsystems
    - d. Design of Systems
  - 2. Systems of Technology
    - a. Agriculture Technology
    - b. Military Technology
    - c. Medical Technology
    - d. Bio-Technology
    - e. Chemical Technology
    - f. Education Technology
    - g. Space Technology
    - h. Industrial Technology
      - (1) Classifying Industrial Technology Systems
        - (a) Energy and Power
        - (b) Communication
        - (c) Materials and Processing
      - (2) Integrating Industrial Technology Systems

C. What Are The Effects of Technology?
   1. Levels of Complexity in Technological Development
      a. Low Level (Craft --> Machine)
      b. Intermediate Level (Machine --> Power)
      c. High Level (Power --> Cybernetic)
   2. Timelines of Technology
      a. Eras of History
      b. Major Civilizations
      c. Important People
   3. Assessment of Technology
      a. Impact of Technology
         (1) Personal
         (2) Societal
         (3) Environmental
      b. Tradeoffs: Benefits and Risks
         (1) Desired/Undesired
         (2) Expected/Unexpected
         (3) Intended/Unintended
      c. Personal Influences on Technology
         (1) Individual Involvement
         (2) Occupational Involvement
         (3) Organizational Involvement
         (4) Political Involvement
   4. Techniques of Forecasting Future Technology
      a. Trend Analyses
      b. Analogies
      c. Delphi Surveys
      d. Decision Networks and Models
      e. Future Histories and Scenarios

Lesson Title: What Is Technology?

Unit Scope: This **unit** is designed to acquaint students with the role of technology in their lives--past, present and future. Through this **lesson** each student will become aware of the definitions, purposes, and components of technology as well as the application of selected curricular areas to technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Select from a list or write several definitions of technology.
2. Select from a list or state at least two purposes of technology.
3. Select from a list or draw a diagram showing the components or resources of technology.
4. Match or state examples of each resource or component of technology.
5. Select appropriate comparative statements or write a paragraph comparing science and technology. *ITE 2.9*
6. State or write a description of at least two applications each of science, mathematics, social studies and language arts to technology. *ITE 2.19*
7. Perform operations using basic tools and machines (i.e.: scissors, shears, ruler, hammer, screwdriver, saw, file, etc.) safely, accurately, and properly as demonstrated by the instructor.
8. Work with other students and instructors in a mutually helpful manner, such as sharing use of equipment, assisting others in team tasks, respecting the rights of others, and responding to reasonable requests of others. *ITE 2.18*
9. Improve work habits, such as dependability, orderliness, neatness, pride in work done well, etc.
10. Complete worksheets and forms accurately and thoroughly.

Content Outline	Teacher Plans and Activities
I. Overview of Technology A. What Is Technology? 1. Definitions of Technology	Accept student definitions of technology by displaying them on a bulletin board, chalkboard, or overhead transparency. Assist them in discussing the content components of the definitions, calling attention to those components common to several definitions.
	Provide a bulletin board space for articles and collages on technology.
2. Purposes of Technology a. Solve Problems b. Extend Human Potential c. Manage Environment	Discuss the purposes of technology.
	Discuss Gould booklet: earliest technologies, early mankind's purpose for technology, the cycle of technology, and the effect of abandoning technology; prepare worksheet.
3. Resources or Components of Technology	Show a model of the resources of technology, discuss what each component includes and give detailed examples.
	Contact local businesses to secure approval for student interviews related to resources.
	Plan activities for mobile, T-shirt logo or display on resources and demonstrate equipment necessary to complete the activity..
	Plan for creative resource utilization exercise.

Suggested Student Activities	References/AV/Supplies/Equipment
Find at least one definition of technology, note the basic content components of the definitions, and write a paragraph describing its meaning.	Chalkboard, overhead projector with transparencies and/or bulletin board.
Create a bulletin board using pictures or news articles pertaining to all kinds of technology. (New York: Intro To Technology, Grade 7, pp. 40; Bame, Activity Manual, pp. 9-12)	Newspapers and magazines with articles on technology for copying or clipping.
Create a poster collage showing the utilization of technology in circumstances, such as natural disasters, rescues, medical problems and food supplies and describe how technology is applied to human and environmental needs. (New York: Intro To Technology, Grade 7, pp. 40)	
Read the Gould booklet on "Technology: Abandon, Endure, or Advance" and respond to worksheet questions related to the reading.	Gould, Inc., "Technology: Abandon, Endure, or Advance," 10 Gould Center, Rolling Meadows, IL 60008. (Part of a series of approximately a dozen related booklets.)
Classify examples of the resources of technology into appropriate categories or pick a resource category to investigate and discuss. (New York: Intro To Technology, Grade 7, p. 20; Listar, Technology Act. Guide 1, p. 83-84)	Transparency or information sheet of a model of the resources of technology.
Survey local businesses to learn of the resources used in operating their enterprise. (New York: Intro To Technology, Grade 7, pp. 20)	
Construct a hanging mobile which displays the resources of technology. (New York: Intro To Technology, Grade 7, pp. 19)	String, scissors, cardboard, and other items for a hanging mobile.
Develop and print a logo for a T-shirt showing the resources of technology. (New York: Intro To Technology, Grade 7, pp. 19-20)	Paper for logo design; screens, ink, T-shirts, stencils, solvents, etc.
Develop a display comparing the percentage of technology used in the United States with the percentage of each of the resources of technology available in the United States. (New York: Intro To Technology, Grade 7, pp. 20)	Materials for display.
Participate in a creative resource utilization exercise.	Materials and equipment for creative resource utilization exercise.

Content Outline	Teacher Plans and Activities
I. Overview of Technology **A. What Is Technology?** 3. Resources or Components of Technology	Provide a problem to be solved, accumulate several different bags of recycled items which may be used by groups to solve a given problem, provide play money for each group. Provide a problem to be solved, such as the firemouse, and provide a variety of materials which may be used in construction, such as straws, pencil, brads, 2-liter bottles, balloon, paper, rubber band, dowel rod, paper cups, juice can lids, clip-on clothespin, candle, etc.
a. Human (1) Principal Final Recipient of Products of Technology	Conduct brainstorming session and discussion on "needs of all individuals". Study Maslow's hierarchy of needs and plan student research related to shelters.
(2) Selected Unique Aspects of Being Human (a) Stand Erect (Bipedal) (b) Rational Thought (c) Opposing Thumb (d) Clasp Objects (e) Stereoscopic Vision and Accurate Focusing	Obtain floor plan of your school and plan research activity related to evacuation routes, safety and special needs accessibility. Plan and initiate activities to gather data related to the human resource.
(3) Sensory Perception (a) Sight (b) Hearing (c) Smell (d) Taste (e) Touch	
b. Tools and Machines (1) Extensions of Human Abilities	Discuss the use of tools and machines as extensions of the human ability to meet basic human needs.
(2) Have Subsystems (a) Support and Cover (b) Energy Transmission (c) Guidance and Control	Discuss the types of subsystems within tools and machines.

Suggested Student Activities	References/AV/Supplies/Equipment
Given a problem to solve, a bag of parts and play money, solve the problem using the exchange of parts and money (fastest model boat, car or rocket). (New York: Intro To Technology, Grade 7, pp. 27)	Bag of appropriate parts and play money for problem solving activity.
Construct a device to serve a specified purpose while adhering to specified resource limitations, such as a firemouse. (New York: Intro To Technology, Grade 7, pp. 27)	(APPENDIX B)
Participate in a brainstorming session on the "needs of all individuals". Discuss whether each need is essential to the survival of all. (New York: Intro To Technology, Grade 7, pp. 41)	Chalkboard or overhead transparency.
Based on Maslow's hierarchy of needs, discuss how technology has helped to satisfy these needs. Organize small group or individual research related to the need for shelter by studying the interrelationship of available resources, shape and structure of shelters, such as adobe huts, igloos, and tepees used by various American Indian tribes. (New York: Intro To Technology, Grade 7, pp. 14)	Reference books on shelters.
Research and modify a floor plan of your school to show evacuation routes, location of safety materials and equipment, and accessibility accommodations for individuals with physical, visual, or auditory impairments. (New York: Intro To Technology, Grade 7, pp. 14)	Copies of scaled floor plan of the school.
Calibrate a weight scale and gather, record and analyze data on the weight of class members.	Weight scale that can be calibrated, an object of known weight for calibration, and forms for recording data.
Using small groups study the human resource by gathering, recording and analyzing data on the depth perception of class members. (Todd, Activity Manual, p. 69)	Device for measuring depth perception and forms for recording data.
List the names and uses of tools and machines that provide for basic human needs during a selected day. (New York: Intro To Technology, Grade 7, pp. 15; Goetsch, pp. 54; Listar, Technology Activity Guide 1, pp. 57-63)	
In small groups analyze a selected machine for its basic subsystems and describe the parts which make up each of the subsystems. (Todd, Activity Manual, pp. 15-16;Listar, Technology Activity Guide I, pp. 171-173)	Worksheets for recording data.

Content Outline	Teacher Plans and Activities
1. Overview of Technology **A. What is Technology?** **3. Resources or Components of Technology**	
b. Tools and Machines (3) Work as Converters of Materials, Energy and Information (4) Operate by Controlling Direction, Form and Intensity of Energy	Discuss the relationship between energy and machines.
c. Materials (1) Nature (2) Characteristics (3) Function	Provide native raw materials for products to be produced. Demonstrate the testing apparatus and the recording and analysis of data. Discuss materials as resources.
d. Material Processes (1) Separating (2) Combining (3) Forming (4) Conditioning	Demonstrate a number of tools and conversion processes by categories.
e. Energy (1) Source (2) Conversion Form (3) Transmission as Power (4) Output as Work	Discuss and demonstrate sources, forms, and conversion of energy.
f. Information (1) Converts Coded Patterns of Material or Energy Into Signals or Symbols With Assigned Meaning (2) Ideas Encoded as Signals or Symbols and Transmitted (3) Signals or Symbols Received and Decoded as Information (4) Measured, Counted or Stored	Demonstrate punched card system for information storage and retrieval. Discuss the use of signals by machines and symbols by people in coding information. Discuss measuring devices for gathering information.

Suggested Student Activities	References/AV/Supplies/Equipment
Research and construct a folk toy using traditional tools and methods (corn husk or apple head dolls, whistles, blocks, etc.) (New York: Intro To Technology, Grade 7, pp. 14)	
Produce a product from native raw materials (from trees, clay, etc.). (New York: Intro To Technology, Grade 7, pp. 15)	Native raw materials for product.
Test, record and analyze a variety of uniform sized material samples for physical characteristics, such as electrical conductivity, heat conductivity, hardness, bending strength, tensile strength, etc. (Todd, Activity Manual, pp. 19-30)	Testing apparatus for materials testing and worksheets for recording data.
At each of the four work stations provided, analyze the examples of materials that have been changed through a conversion process and record the findings. (Todd, Activity Manual, pp. 31-45; Listar, Technology Activity Guide 1, pp. 85-93)	Materials representing the four categories of processing and worksheets for recording data.
Process a food product. (Bame, Activity Manual, pp. 23-24; Todd, Activity Manual, pp 119-125; Heiner, Activity Manual pp. 85-86; New York: Intro To Technology, Grade 8, Module T-7)	Food and processing equipment.
Design and construct an energy conversion device, such as a thermocouple, a voltaic cell, a solar collector, a magneto or generator. Measure its output quantity and calculate the cost of that energy form over a given period of time. (New York: Intro To Technology, Grade 7, pp. 20; Todd, Activity Manual, pp. 47-56; Bame, Activity Manual, pp. 29-44; Heiner, Activity Manual, pp. 87-92)	Materials for designing and constructing an energy conversion device.
Develop a punched card information storage and retrieval system related to students names, birth dates, locker numbers, sex, class schedule and teachers, etc. (Todd, Activity Manual, pp. 61-63)	Punched cards and long pin for retrieval.

Content Outline	Teacher Plans and Activities
1. Overview of Technology **A. What Is Technology?** **3. Resources or Components of Technology** g. Capital (1) Means of Exchange (a) Barter (b) Money (c) Stocks and Bonds	Discuss capital as a resource.
	Discuss items used as capital in barter systems.
(2) Investments (a) Equipment (b) Facilities (c) Land	Secure a plat book and discuss information provided in a land survey.
h. Time (1) Human Limitations (2) Natural Constraints (3) Importance of Time (a) Agriculture Age (b) Industrial Age (c) Information Age	Secure models or drawings for various timekeeping devices and demonstrate equipment used in producing a timekeeping device. Discuss "Time As A Resource In Technology". Order film on high technology.
4. Comparisons and Applications of Other Curricular Areas to Technology a. Science b. Mathematics c. Social Studies/Civics d. Language Arts/Reading/English	Discuss the differences between science and technology and give examples of activities for each. Discuss how technology involves the application of science, mathematics, social studies, and language arts and give examples of each.

Suggested Student Activities	References/AV/Supplies/Equipment
View a film produced by a city for community development or industrial expansion and discuss the effect of the potential loss or addition of a specified company (cable television, taxi, ambulance, dairy processing plant, hospital, lawn mower assembly plant, savings and loan association) to the community. Give special emphasis to the human and capital resources.	Film on community development or industrial expansion.
Establish a simulated barter/reward system in class with specific "capital" (e.g., tokens, chips, coupons, cards). (New York: Intro To Technology, Grade 7, pp. 19)	Tokens, chips, coupons, cards, etc., for barter system.
Generate ideas on how to invest profits from an imaginary manufacturing company. (New York: Intro To Technology, Grade 7, pp. 20)	
Simulate an investment of $1000 to purchase any stock or bond listed in the stock market report of a local newspaper, graph a daily entry and calculate loss or gain on a predetermined date. (New York: Intro To Technology, Grade 7, pp. 20)	Stock market report from local newspaper and graph paper.
Read a plat book and draw a specified land description. (Bame, Activity Manual, pp.103)	Sample plat books and topographic maps.
Read a topographic map by completing a worksheet.	
Research and produce one or more timekeeping devices, such as a water clock, sand clock, rope clock, sun dial, mechanical clock, digital clock, etc. (New York: Intro To Technology, Grade 7, pp. 15; Hacker, Living With Technology Activity Manual, pp. 44-45; Todd, Activity Manual, pp. 159-162)	Materials and plans for timekeeping devices.
View a film or video tape on high technology, such as "For Years To Come" (by Chrysler).	Marathon International Productions, 211 E. 51st Street, New York, NY. 10022--free loan
Show the relationship of selected technological activities to science, mathematics, social studies and language arts.	Examples of technological activities which apply to other curricular areas.
Support the work of a teacher in another discipline to help teach a concept.	
Complete crossword puzzle for Lesson I-1.	(APPENDIX C)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References:

Bame, et al., Exploring Technology, Davis, 1980, pp. 11-13.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 3-25, 42-47.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 2-10, 27-41.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 2-12, 26-47.
Heiner, et al., People Create Technology, Davis, 1980, pp. 10.
Heiner, et al., People Create Technology, Teacher's Guide, Davis, 1980, pp. 10, 13, 14, 20, 25, 31-35.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 4-24, 120-121.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 1-6, 7-9, 11-12.
Williams, et al., Technology At Work, South-Western, 1987, pp. 18, 32-41, 47, 48-67.

Revision Notes:

Lesson Title: How Is Technology Organized?

Unit Scope: This **unit** is designed to acquaint students with the role of technology in their lives--past, present and future. Through this **lesson** each student will learn to analyze and synthesize the elements of technological systems and to classify technological developments (from the early simple tools and methods to the present day complex machines and methods) into various systems with special emphasis on the three industrial technology subsystems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: closed-loop system, open-loop system, feedback, sensing, automated, systems analysis, industrial technology systems, communication technology, materials and processing technology, energy and power technology, integrate, scope.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List or select from a list the elements included in closed-loop technological systems and sketch their relationships. *ITE 1.1*
4. Increase their awareness of and trust in the use of human senses in the feedback component of a system.
5. Identify and sketch the elements of selected technological systems. *ITE 1.1*
6. List at least three categories of technology in addition to industrial technology and give examples of what may be included in each. *ITE 2.1, 2.2*
7. List the three major systems of industrial technology and give examples of what may be included in each. *ITE 2.3 , 2.4, 2.5, 2.6*
8. Recognize that technology is included in many aspects of their everyday world.
9. Participate in a group analysis of a technological system and/or complete a worksheet analyzing a technological system. *ITE 1.1*
10. Participate as an individual or in a group to assemble standard technological components into a new system. *ITE 1.2*
11. Participate in the group development and construction or manufacture of a product integrating the three systems of industrial technology.
12. Perform safely the operations needed to manufacture or construct a product as demonstrated. *ITE 2.18, 5.8, 5.15*

Content Outline	Teacher Plans and Activities
I. Overview of Technology B. How Is Technology Organized? 1. The Systems Approach	Make reading assignments.
a. Types of Systems (1) Open Loop (no feedback)	Distinguish between open- and closed-loop systems.
(2) Closed Loop (includes feedback) b. Elements of Systems (1) Purpose (2) Input (3) Process (4) Output (5) Feedback	Describe closed-loop system model and give examples of what might be included in each element of the model. Illustrate closed-loop systems with examples from various aspects of daily life, such as the systems of the human body, the home heating system, an automated assembly line, etc.
	Lead class discussion related to the use of the human senses as feedback mechanisms and the adjustment of technological systems based thereon. Consider the concept that the full development of all senses enhances human awareness of the technology/environment interaction. Also consider the effect of an impairment of any of the senses as an opportunity or an obstacle to fuller development of the senses.
c. Analysis of Systems (1) Supersystems (2) Subsystems	Provide examples of several automated feedback systems and demonstrate how they operate, such as home heating system with thermostat, dawn to dusk lights, traffic activated stoplight, automated door opener, automated fire-sprinkler system, sump pump, radio with alarm, snooze, and sleep functions, Polaroid camera.
	Demonstrate how to analyze household equipment with automated feedback devices for the elements of a technological system.
	Demonstrate the operations necessary to build a rocket-powered spacecraft as well as the proper procedure for completing the computations needed for the worksheet.

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Draw a flow chart of an open- and closed-loop system.	Chart or overhead transparency showing open- and closed-loop systems. (Listar, Technology Activity Guide 1, 1987, pp. 161-167, 175-177)
Choose two favorite activities and identify the human senses that are used to do these activities. Indicate how the senses help one perform the activity and what devices might be used to replace the human senses. (New York: Intro To Technology, Grade 8, Module T-8, p. 12; Listar, Technology Activity Guide 1, 1987, p. 169)	Chart or overhead transparency showing the human senses.
Draw a line centered between two parallel lines and/or draw the mirror image of a given irregular image, such as a candelabra. Be aware of the visual feedback used in locating the exact position of the line. (New York, Intro To Technology, Grade 7, pp. 34)	Worksheet showing parallel lines and/or half of a mirror image.
Participate in a brainstorming session on sensing devices and automated feedback systems. Classify the examples according to light activated, sound activated, heat activated, time activated, motion activated, etc. systems. Determine which examples have sensing devices that control automated feedback systems. (Todd, Activity Manual, pp. 165)	Models of closed-loop system, such as thermostat, automated door opener, sump pump, Polaroid camera, radio, etc.
Bring pictures of examples of sensing devices and automated feedback systems and display on a bulletin board using a classification system.	Bulletin board space.
Discuss household items viewed in systems terms, such as a toilet and tank float mechanism, oven, refrigerator, or home heating system. (New York: Intro To Technology, Grade 7, Module T-4, p. 33-34; Listar, Technology Activity Guide 1, 1987, p. 171-173)	
Build a rocket-powered spacecraft, analyze for systems used, and complete worksheet related to flight altitude, etc. (Hacker, Living With Technology, pp. 74-78; New York: Intro To Technology, Grade 7, Module T-4, pp. 33)	Rocket kits or materials for building rockets, equipment for building rockets and finishing materials for rockets; rocket launch equipment and field location; worksheets for calculating flight altitudes, etc.

Content Outline	Teacher Plans and Activities
I. Overview of Technology **B. How Is Technology Organized?** **1. The Systems Approach**	Arrange for field trip. Conduct a discussion related to technological systems to be viewed on the field trip prior to and following the field trip.
d. Design of Systems	Demonstrate the application of the systems model in the design of a new technological system and lead the students through the design of a new system to accomplish a specific outcome. Lead a discussion related to the building of a machine with feedback capability and give necessary demonstrations for students to complete the machine.
2. Systems of Technology a. Agriculture Technology b. Military Technology c. Medical Technology d. Bio-Technology e. Chemical Technology f. Education Technology g. Space Technology h. Industrial Technology (1) Classifying Industrial Technology Systems (a) Energy and Power (b) Communication (c) Materials and Processing	Discuss various systems of technology emphasizing that (1) no universal agreement exists on the classification of these systems, (2) there is much overlap between the systems, and (3) the application of technology encompasses all aspects of our society. Outline three industrial technology sub-systems, describe what each includes, and how they all interrelate. Lead discussion prior to and following viewing of film on how society has changed during the last century as a result of industrial technology systems.
(2) Integrating Industrial Technology Systems	Demonstrate necessary operations for completion of group project integrating industrial technology systems.

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a field trip to local businesses or industries to observe the use of technological systems which include sensors and/or automated feedback systems. Examples: bank (check readers and automated accounting), grocery store (UPC reader, cash register, inventory; automated door), post office (mail readers), newspaper office (news wire printer, human senses for color matching and detecting mechanical problems), bakery, dairy processing plant, or manufacturing plant.	Models or overhead transparencies of several technology systems typically found in local businesses.
Design a system for bringing about a specific outcome, such as calmly and safely evacuating the classroom for a fire drill, loading and unloading the bus at school, collecting and returning papers in your class, etc. (Goetsch, p. 75)	
Build a machine with feedback capability. (Todd, Activity Manual, pp. 163-165)	(Don Herbert, Mr. Wizard's 401 Experiments in Science, 1968, Book-Lab, Inc., 1449-37th St., Brooklyn, NY 11218; Listar, Technology Activity Guide 1, 1987, p. 179-195)
List "things" believed to be technology. Interact with other students by sorting the combined list into the major categories of technology listed on a chalkboard or overhead transparency.	
Complete small group research on the scope of a designated system of technology. Prepare a bulletin board display explaining the system. Study the other displays using a worksheet and participate in a group discussion on systems of technology.	Bulletin board; worksheets for analysis of technology displays.
Participate in a class discussion on the three industrial technology systems emphasizing the scope of each. List some of the technological developments that are included in each.	Chalkboard or overhead projector.
View a film on industrial technology systems and discuss how society has changed during the last century as a result of these systems.	Film on industrial technology systems.
Complete a group project which blends the three areas of industrial technology, such as book markers (Heiner, People Create Technology, Teacher's Guide, p. 51), transmission tower project (Fales, p.416-420), production line project (Fales, p. 421-429), model CO_2 racer, (Bohn, Activity Guide, p. 89-92).	Materials and equipment to produce the selected project.
Complete a vocabulary worksheet for Lesson II-2.	(APPENDIX B)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 15-19, 275-284.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 56-58, 317-382.
Hacker, et. al., Living With Technology, Delmar, 1988, pp. 48-56.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 102-111, 294-323, 328-356.
Heiner, et al., People Create Technology, Davis, 1980, pp. 78-82, 85-91, 99, 103, 107-109, 120-125, 169-198.
Heiner, et al., People Create Technology, Teacher's Guide, Davis, 1980, pp. 45-46, 48-51.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 116-123.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 4-5, 30-31, 57-60, 308-314, 378-381.
Todd, et al., Understanding and Using Technology, Teacher's Guide, Davis, 1980, pp. 1-6, 34-35, 37-39, 80-81, 116-118, 123-124.
Williams, et al., Technology At Work, South-Western, 1987, pp. 71-85, 89-99.

Revision Notes:

Lesson Title: What Are The Effects Of Technology?

Unit Scope: This **unit** is designed to acquaint students with the role of technology in their lives--past, present and future. Through this **lesson** each student will learn that technology has developed through several levels of complexity; that technology can be traced along a timeline using various points of reference; that technology creates personal, societal, and environmental impacts; and that several techniques may be used in forecasting future technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: low level technology, intermediate level technology, high level technology, timeline, environmental impact, societal impact, personal impact, trend analysis, analogies, Delphi study, decision network, model, future history, scenario.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List the three levels of complexity of technological development and state two characteristics of each.
4. Explain how one level provided a base for subsequent levels in the evolution of technology. *ITE 2.11, 2.12*
5. Develop a timeline tracing the development of a specific technology, machine, or tool. *ITE 2.10*
6. List three categories of technology's impact in our culture. *ITE 2.7*
7. State examples of both the positive and negative impacts of technology in each of the categories of cultural impact. *ITE 2.8, 2.12*
8. Using the examples cited in the preceding competency, recognize that benefits, risks and tradeoffs are associated with each. *ITE 2.12*
9. Create a realistic technological device or process for use in the future. *ITE 2.13*
10. Use a forecasting technique to predict a future societal need and a technological solution for that need. *ITE 2.13*
11. Gather information using the interview technique, synthesize the information and present the findings to a group.
12. Select the proper tool or machine for completing a task efficiently.
13. Perform safely the operations for constructing a simple machine and/or a model of a future technological device.

Content Outline	**Teacher Plans and Activities**
I. Overview of Technology C. What Are The Effects of Technology? 1. Levels of Complexity in Technological Development a. Low Level (Craft --> Machine) b. Intermediate Level (Machine --> Power) c. High Level (Power --> Cybernetic)	Make reading assignments. Discuss the three levels of complexity in technological development. Organize small groups, plan and communicate presentation format, and assign topic.
	Make necessary arrangements for interviews with community residents and video taping of interviews.
	Lead discussion prior to and following film on high technology for securing raw material.
	Organize groups and locate space for poster or bulletin board displays; consider library, main entrance, or cafeteria display areas.
	Arrange for field trip and lead discussion prior to and following field trip.
	Locate Model-T and modern day automobile or video tapes of same and lead discussion comparing their systems.
	Arrange for industrial field trip and lead discussion prior to and following field trip.
	Order film and lead discussion prior to and following viewing of film.
	Demonstrate the levels of complexity in technological developments, such as drilling, sawing, printing, plowing, transporting, etc.
	Select plans for simple tools which illustrate low complexity level. Demonstrate operations necessary for construction of tools. Discuss tools which evolved from these simple tools.

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
In small groups prepare a presentation to the class showing the historical development which has occurred for securing a specified raw material, such as drilling for oil; harvesting lumber, grain, or fish; mining coal, iron ore or rock; slaughtering cattle or poultry, etc.	References for preparing class presentations.
Participate in an interview with long-term residents of the community who would share their past experiences related to securing and/or processing raw materials.	Video tape equipment and cassette. (Video tape for future use.)
View a film/video tape showing high level technology currently used for securing a specified raw material discussed in a presentation.	Film or video tape showing use of a high level technology currently used for securing a specified raw material.
In teams of three create a poster or bulletin board display showing the three levels of complexity in the development of the tools for processing raw materials, such as sawing trees into lumber, preserving milk or similar foods, building a road, processing grain, preserving public records, sending messages over long distances, dental care, etc.	Bulletin board or poster materials.
Participate in a field trip to a collector, a museum or an industry with artifacts of equipment showing lower or intermediate levels of complexity, such as historical theme parks, restored villages, industrial displays, theme "halls of fame", historical libraries and museums, antique or collectable dealers.	
Participate in a field trip or view a video tape to study the systems of a pre-1925 automobile (e.g. Model-T Ford) and discuss its comparison with modern day automobiles.	A pre-1925 automobile and a modern day automobile or a video tape of a pre-1925 automobile and modern day automobile systems.
Participate in a field trip to an industry or food processing plant with a high level of complexity in its processing equipment.	
View a film or observe a demonstration of equipment showing one or more levels of complexity in technological development.	Film or video tape showing various levels of complexity in technological development.
Build simple tools which illustrate the low complexity level in technological development. (Todd, Activity Manual, pp. 5-16; Heiner, Activity Manual, pp. 9-10, 13-28)	Materials and equipment for building simple tools.

Content Outline	Teacher Plans and Activities
I. Overview of Technology **C. What Are the Effects of Technology?** 2. Timelines of Technology a. Eras of History b. Major Civilizations c. Important People	Make reading assignments. Discuss the use of a timeline as a method of organizing and displaying data.
	Plan timeline activity, mount timeline. provide list of significant technological developments or events. (Goetsch, pp. xvi; Strandh, A History of the Machine, A & W Publishers, Inc., N. Y., 1979; A Timetable of Technology, Hearst Books, 1982; Hacker, Technology In Your World, p. 388-391; Hacker, Living With Technology, p. 517-520; Listar, Technology Activity Guide 1, 1987, p. 73-80)
	Through the use of color coded cards attached at varying heights, the timeline could be used for developments, innovators, and eras simultaneously.
	Assign subject for research and paper; and plan discussion and organize the duplication and fastening of booklet.
	Plan guidelines for development of game or crossword puzzles.

Suggested Student Activities	References/AV/Supplies/Equipment
With the help of a close family member, develop a personal timeline which begins 10 years prior to birth and extends 25 years from the present. This would include significant events of your personal life and might include other historical events of national significance. Later, this timeline may be used in establishing personal goals.	Posterboard and markers for making personal timeline.
Using an existing list of significant technological developments or events, develop a technology timeline by attaching typewritten cards or tags at proportionate locations to represent each technological development or event along the timeline. This timeline can show the exponential growth rate of technology.	Folded computer paper and markers, or fine wire or fishing line, multi-colored cards or tags; fastening devices (paper clips, safety pins, staples, thumbtacks, ribbon or string). Copeland, Peter F., Early American Trades Coloring Book, Dover Publications, 180 Varick St., New York, 10014, 1980.
Using a separate or the previously mentioned timeline, develop a "significant technological innovator" timeline. In order to provide a time perspective, this activity could also be expanded to include world leaders and other significant contemporaries.	
Indicate along the timeline of technology the dates designating various eras of history or major civilizations and through discussion summarize the technological developments which occurred during each time period.	Wilkie, Leighton A., "Civilization Through Tools", depicting educational exhibit at the Chicago Museum of Science and Industry, Wilkie Brothers Foundation, Des Plaines, IL, 1981.
Research a significant technological development or innovator, then discuss these developments and innovators in relation to the century involved and the present, and write or type a one to two page paper describing the contribution of the development or innovator to our present day culture. Sketches or photos may be added to further describe the topic. These papers may be compiled for a given class, duplicated, pub-published as a booklet and distributed to the class members. The booklet could be organized chronologically with different colored sheets representing different categories of technology. (Goetsch, pp. 25; Listar, Technology Activity Guide 1, pp. 1-5)	Duplicating or copying equipment, multi-colored paper for booklet, fasteners for booklet.
Create and/or participate in a game similar to "win, lose or draw", "concentration", "trivial pursuit", or crossword puzzles using inventors, technological devices and time periods.	Material for game or puzzles.

Content Outline	Teacher Plans and Activities
I. Overview of Technology **C. What Are the Effects of Technology?**	Specify procedure for assignment related to bulletin board display of current news articles.
3. Assessment of Technology a. Impact of Technology (1) Personal (2) Societal (3) Environmental b. Tradeoffs: Benefits and Risks (1) Desired/Undesired (2) Expected/Unexpected (3) Intended/Unintended	Prepare lecture/discussion on impacts of technology and the importance of evaluating the tradeoffs when assessing technology. Ask: Who will be helped or hurt?, Can the negative be overcome?, Does the harm outweigh the good?, etc. Prepare worksheet for classifying the impacts of technological devices.
	Lead discussion about the technological changes that have occurred during the lifetime of the older citizens of the community.
	Prepare or lead students in developing an interview form. Demonstrate how to conduct an interview using an interview form. Compile the interview findings into a functional format and lead a discussion related to the frequency distribution, the time period, the effects of the change, the significant public figures or events and the speculated alternative lives.
	Assign research teams and topics; plan with the class the discussion and role playing activities; plan the followup activity; videotape role playing activities for future reference.
c. Personal Influences on Technology (1) Individual Involvement (2) Occupational Involvement (3) Organizational Involvement (4) Political Involvement	Arrange for guest speaker presentation or prepare lecture/discussion related to the influence that individuals may have on technological development through their individual effort as well as through their group efforts in their occupation, in organizations, and in the political process.
	Cite examples or prepare videotape of a TV show with some violence. Prepare discussion questions related to the tradeoffs involved in the technology of television.
	Prepare lecture/discussion on the tradeoffs involved in recycling materials; prepare for the construction of a recycling device: develop plans, secure materials, give necessary demonstrations, and initiate construction.

Suggested Student Activities	References/AV/Supplies/Equipment
Bring current news articles related to the impact of technology for a bulletin board display. These may be obtained from newspapers, news magazines, technical reports, summary of radio or television news report, etc.	Bulletin board space; recent news magazines, newspapers, and technical reports.
Going back approximately fifty to seventy-five years on the technology timeline, complete a worksheet classifying the impacts of each device of that time period as having a (1) desirable/undesirable; expected/unexpected; and intended/unintended impact, and (2) personal, societal, or environmental impact.	Worksheet for classifying impacts of technological devices. (Listar, Technology Activity Guide 1, 1987, pp. 199-213)
Interview an experienced family or community member about the impacts that the two most significant technological changes have had on his/her personal life. Using a prepared interview form, identify both the negative and positive impacts which he/she felt, speculate how life might have differed without the occurrence of this change, indicate the approximate time period covered, and list the significant public figures or events of that time. Participate in a discussion related to the findings of the interviews. Related activities might include writing a letter requesting an interview and a letter of appreciation for the interview.	Interview form; paper, envelopes and stamps for letters; chalkboard, overhead projector and transparencies, or flipchart and easel.
Participate on a student team to research and discuss or roleplay the conflicts (tradeoffs) of a recent technological issue, e.g nuclear power plants, noise pollution (supersonic transport airplanes, rock music, superdome fans), channelization of rivers, reclamation of wildlife habitat, transportation of coal slurry, Alaskan pipeline, scrambling of cable television, X-rays, solid waste disposal, etc. Write a letter, phone a person or make a speech to express an opinion on a technological issue. (New York, Intro To Technology, Grade 7, pp. 40-41)	Video camera for videotaping role playing activities or discussions.
Recall or view a videotape of a TV show with some violence and discuss desired/undesired, and expected/unexpected results of television. (New York, Intro To Technology, Grade 7, p. 41)	Videotape of a TV show with violence.
Construct a recycling device, (solar still to reclaim clean water, paper baler, can crusher, etc.). (New York, Intro To Technology, Grade 7, pp. 41; Bame, Activity Manual, pp. 15-21)	Plans and materials to construct a selected recycling device.

Content Outline	Teacher Plans and Activities
1. Overview of Technology **C. What Are the Effects of Technology?** 4. Techniques of Forecasting Future Technology a. Trend Analyses b. Analogies c. Delphi Surveys d. Decision Networks and Models e. Future Histories and Scenarios	Prepare lecture/discussion on case studies of techniques for forecasting future technology. Establish groups and prepare them for the group activity using techniques of forecasting future technology.
	Prepare worksheets "When I'm A Grandparent"; order video cassettes "Futureview: A Look Ahead"; and lead discussions related to future technology which follow these activities.

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in group activities applying techniques of forecasting future technology	Worksheet describing group activities applying techniques of forecasting future technology. (APPENDIX B)
In an area of special interest to the student and using a technique of forecasting future technology, predict a societal need ten to twenty years in the future and describe a realistic technological solution for that need by making a model, completing a drawing, or writing a paper of two to three pages (Hacker, Technology In Your World, pp. 408; Hacker, Living With Technology, pp. 514-515, 546-547; Todd, Activity Manual, pp. 167-169; New York, Introduction To Technology Grade 8, Review TLA, pp. 1-7; Listar, Technology Activity Guide 1, 1987, pp. 215-229; "Classroom Guide: The EPCOT Center Experience", pp. 32-57).	Plans, materials and equipment to construct a model, complete a drawing or write a paper related to forecasting future technology.
Read the "Fifty Years" column of newspapers or very old editions of publications, such as Popular Science, for indications of the technology of the day and report findings to the class.	
Complete the worksheet "When I'm A Grandparent" and discuss your reactions with the class.	(APPENDIX B)
View a video cassette related to future technology, such as "Futureview: A Look Ahead" (Burrus Research Associates, P.O. Box 1354, Waukesha, WI 53187, six-cassette set; $65).	
Complete a vocabulary worksheet for Lesson I-3.	(APPENDIX B)

The following books on technology in early America were written and illustrated by Eric Sloane:

ABC Book of Early Americana
American Barns and Covered Bridges
Diary of an Early American Boy: Noah Blake--1805
A Museum of Early American Tools
Return to Taos: A Sketchbook of Roadside Americana
The Seasons of America Past
An Age of Barns
American Yesterday
The Cracker Barrel
A Reverence for Wood
Eric Sloane's Almanac
Our Vanishing Landscape

Similar books have been written and illustrated by Edwin Tunis and other authors.
Articles written by high school students on early American technology are included in The Foxfire Book, Foxfire II, Foxfire III, and Foxfire IV. (Bame, et al., Exploring Technology, Davis, 1980, p. 31)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 19-30, 269-275.
Goetsch, et al., Technology and You, Delmar, 1987, pp. xv-xxiii, 3-24, 42-47, 62-72, 363-364, 388-404.
Groneman, et al., General Industrial Education and Technology, 7th Ed., McGraw Hill, 1986, pp. 15-49, 63-72.
Hacker, et. al., Living With Technology, Delmar, 1988, pp. 6-21, 67-73, 484-520.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 52-57, 123-125, 164, 204, 360-362, 366-385.
Heiner, et al., People Create Technology, Davis, 1980, pp. 25-47, 85-94, 205-245.
Heiner, et al., People Create Technology, Teacher's Guide, Davis, 1980, pp. 20-21, 59-63, 65-68.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 24-86, 121-123.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 1-5, 317-334, 337-356, 368-369.
Todd, et al., Understanding and Using Technology, Teacher's Guide, Davis, 1980, pp. 14-16, 126-144.
Williams, et al., Technology At Work, South-Western, 1987, pp. 5-14, 353-369.

Selected Readings On Timeline of Technology

A Timetable of Technology, Hearst Books, 1982.
Strandh, A History of the Machine, A & W Publishers, Inc., N. Y., 1979.

Revision Notes:

UNIT II

WORKING WITH TECHNOLOGY

LESSON 1
FUNDAMENTALS OF MEASUREMENT

- REASONS FOR MEASURING
- STANDARD SYSTEMS OF MEASUREMENT
- IDENTIFYING THE ACCURACY OF MEASUREMENT

LESSON 2
INFORMATION PROCESSING

- PURPOSES OF INFORMATION PROCESSING
- CATEGORIES OF DATA
- GATHER AND RECORD DATA
- SELECT, ORGANIZE & CALCULATE DATA
- STORE AND RETRIEVE INFORMATION

LESSON 3
PROBLEM SOLVING TECHNIQUES

- FORMAL PROBLEM SOLVING PROCESSES
- INFORMAL PROBLEM SOLVING PROCESSES

LESSON 4
GROUP ORGANIZATION AND MANAGEMENT

- INTRODUCTION
- ORGANIZATIONAL LEVELS AND FUNCTIONS
- ORGANIZATIONAL LEADERSHIP
- SELECTED FACTORS INFLUENCING THE EFFECTIVENESS OF A GROUP AS AN ORGANIZATION

LESSON 5
SAFETY

- AREAS NEEDING PROTECTION
- PERSONNEL PROTECTION
- WRITTEN SAFETY REGULATIONS
- REPORTS AND INSPECTIONS
- EMERGENCY PROCEDURES

LESSON 6
UNDERSTANDING WORK/YOURSELF

- UNDERSTANDING THE MEANING OF WORK
- UNDERSTANDING YOURSELF

LESSON 7
EXPLORING OCCUPATIONS

- STUDYING OCCUPATIONAL REQUIREMENTS AND TRENDS
- STUDYING OCCUPATIONAL INFORMATION
- STUDYING EDUCATIONAL OPPORTUNITIES
- EXPLORING POTENTIAL OCCUPATIONS
- PREPARING FOR THE FIRST JOB
- KEEPING A JOB

LESSON 8
COMPUTERS

- OVERVIEW OF COMPUTERS
- HISTORY AND DEVELOPMENT OF COMPUTERS/TIMELINE
- HARDWARE
- SOFTWARE
- SELECTED APPLICATIONS

UNIT II: WORKING WITH TECHNOLOGY

II. Working With Technology
  A. Fundamentals of Measurement
    1. Reasons for Measuring
      a. Describe an Object
      b. Describe a Quantity
      c. Construct an Object
      d. Control an Object
    2. Standard Systems of Measurement
      a. Purposes for Standardization
        (1) Interchangeable Parts
        (2) Quantity Production of a Few Sizes
        (3) Fit the Human Body
        (4) Limit Inventory
      b. Standardizing Organizations
        (1) International Standards Organization
        (2) American National Standards Institute, Inc.
      c. Metric Units
        (1) History
        (2) Pros and Cons
        (3) Standard Units
        (4) Prefixes
        (5) Converting Between Units
        (6) Standard Format and Abbreviations
        (7) Reading a Full-Size Scale
      d. Customary (English) Units
        (1) History
        (2) Human Body as Standardized Units
        (3) Pros and Cons
        (4) Standard Units
        (5) Converting Between Units
        (6) Standard Abbreviations
        (7) Reading a Full-Size Scale
      e. Unique Units for Special Purposes
      f. Devices of Measurement
      g. Applications of Measurement
    3. Identifying the Accuracy of Measurement
      a. Need for Precision and Tolerance
      b. Specifications
      c. Inspection/Quality Control
  B. Information Processing
    1. Purposes of Information Processing
      a. Gather and Record New Data--Input
      b. Organize Data Into New Relationships--Process
      c. Provide a Basis for Decisions--Output
      d. Remember Happenings--Storage

2. Categories of Data
    a. Object and Specimen
    b. Photograph and Drawing
    c. Text
    d. Numeric
    e. Transactional Data
3. Gather and Record Data
    a. Techniques
        (1) Primary Sources
            (a) Survey Questionnaire/Interview
            (b) Observation
            (c) Group Interaction
            (d) Collect Sample
            (e) Experimentation
            (f) Photograph
            (g) Sketch/Drawing
            (h) Scholarly Journal
            (i) Report Literature
            (j) Newsletter
            (k) Other
        (2) Secondary Sources
            (a) Abstract
            (b) Review
            (c) Reference Book
            (d) Manual
            (e) Other
    b. Devices
        (1) Simple Writing Tools
            (a) Chalk/Slate/Chalkboard
            (b) Pen/Pencil/Paper
        (2) Typewriter/Dictating Machine
        (3) Copying/Printing Machine
        (4) Computer/CAD
        (5) Other
4. Select, Organize and Calculate Data
    a. Techniques
        (1) Chart, Graph and Table
        (2) File
            (a) Chronological Timeline
            (b) Category/Subject
            (c) Alphabetical/Numerical
            (d) Punched Card
        (3) Software Program
    b. Devices
        (1) Manual Sorting/Calculating
        (2) Mechanical
            (a) Abacus
            (b) Cash Register
            (c) Typewriter
            (d) Billing/Classifying/Tabulating Machines
            (e) Calculator
        (3) Electronic Computer

5. Store and Retrieve Information
   a. Techniques
      (1) Index
      (2) File
      (3) Information Center
      (4) Hard Copy (book, paper, photo print)
      (5) Record
      (6) Microform (fiche card, video tape, aperture card)
      (7) Magnetic (VCR cassette, floppy disk, tape)
      (8) Computer (e.g. card catalog)
   b. Devices
      (1) Printing Press
      (2) Camera
      (3) Record Player
      (4) Microform Camera and Reader/Projector
      (5) Magnetic Recorder and Player
      (6) Computer

C. Problem Solving Techniques--"The Technological Method"
   1. Formal Problem Solving Processes
      a. Identify and State Problem
      b. Gather Known Information
      c. Propose All Possible Solutions
         (1) Brainstorming
         (2) Forced Relationships
         (3) Other
      d. Evaluate Solutions
         (1) Select Evaluative Criteria
         (2) Experiment with Ideas, Sketches and Models
      e. Select and Apply Best Solution
         (1) Make Necessary Drawings and Models
         (2) Develop Implementation Plan
      f. Evaluate Implemented Plan
      g. Applications in Research and Development
   2. Informal Problem Solving Processes
      a. Clearly Define Problem
      b. Consider All Options
      c. Select Best Option

D. Group Organization and Management
   1. Introduction
      a. Need for Organizing Groups
      b. Need for Group Designation of Leader
      c. Need for Group Member Participation in Committees
      d. Need for Group Information/Communication
      e. Need for Group Rules/Standard Practices
         (1) Organizational Manual
         (2) Standard Practices Manual
   2. Organizational Levels and Functions
      a. Type of Organizational Format
         (1) Line
         (2) Staff
         (3) Other

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- b. Format Based on Function of Organization
  - (1) By Activity
  - (2) By Function
  - (3) By Process
  - (4) By Equipment
  - (5) By Location
  - (6) By Product
  - (7) By Category of Customers
- c. Levels of Industrial Management/Labor
  - (1) Upper Management
  - (2) Middle Management
  - (3) Supervisor/Foreman
  - (4) Skilled Workers
  - (5) Operators
  - (6) Unskilled Workers
- d. Functions of Management
  - (1) Planning
  - (2) Organizing
  - (3) Staffing
  - (4) Directing
  - (5) Controlling
  - (6) Coordinating

3. Organizational Leadership
   - a. Appointed
     - (1) Industry
     - (2) Business
     - (3) Government
   - b. Elected
     - (1) Labor Union
     - (2) Service/Social Clubs
     - (3) Government
4. Selected Factors Influencing the Effectiveness of a Group as an Organization
   - a. Commitment to the Organization
     - (1) Employee Ownership
     - (2) Quality Circles
     - (3) Employee Profit Sharing
   - b. Authority/Responsibility/Accountability Within the Group
     - (1) Legal Authority
     - (2) Authority of Knowledge/Personality
     - (3) Authority By Consent of Followers
   - c. Formal/Informal Channels of Communication
   - d. Size of Organization/Span of Control
   - e. Educational Level of Members
   - f. Recognition Program for Members
   - g. Other

E. Safety

1. Areas Needing Protection
   - a. Person
   - b. Society
   - c. Environment
2. Personnel Protection
   - a. Attitude and Behavior

- b. General Safety Hazards
    - (1) Liquid on Floors
    - (2) Lifting Heavy Objects
    - (3) Horseplay in Laboratory
    - (4) Other
- c. Conditions Requiring Special Personal Protective Equipment
    - (1) Noise
    - (2) Light Flash
    - (3) Heat
    - (4) Chemicals
    - (5) Weight
    - (6) Dust/Shavings/Debris
    - (7) Other

- 3. Written Safety Regulations
    - a. Laboratory Inspections
    - b. State Requirements
    - c. OSHA
- 4. Reports and Inspections
    - a. Potential Hazards
    - b. Unsafe Conditions or Practices
    - c. Accidents
    - d. Documentation
- 5. Emergency Procedures
    - a. Fire
    - b. Severe Weather
    - c. Accident or Illness
    - d. Other

F. Understanding Work/Yourself

- 1. Understanding the Meaning of Work
    - a. Why Do We Work?
        - (1) Income
        - (2) Activity
        - (3) Respect
        - (4) Social Contact
        - (5) Creative Expression
    - b. Factors Defining Work
        - (1) Continuous
        - (2) Productive--Goods or Services
        - (3) Efficient
        - (4) Intrinsic and/or Extrinsic Purpose
        - (5) Physical and/or Mental Exertion
        - (6) Regularly Scheduled Basis
        - (7) Sociological Relationships
        - (8) Involves Some Constraint
    - c. Concepts of Work Ethic
        - (1) All Honest Work Possesses Worth
        - (2) Excellence is Rewarded in Any Occupation
        - (3) One Should Always Strive to do His/Her Best
        - (4) Less Than Best Leads to Self-Dissatisfaction
        - (5) One's Contribution to Society is Largely Through Work
        - (6) Work Brings Intrinsic and/or Extrinsic Rewards
        - (7) Advocates of a Work Ethic Prefer to Work
        - (8) Personal Pride is Largely Work Related

2. Understanding Yourself
    a. Personal Abilities, Interests, and Goals
    b. Geographic Preferences
    c. Educational Preparation and Flexibility
    d. Preferences for Type of Job and Co-Workers
3. Sources of Information
    a. Observations By Self and Others
    b. School Classes and Grades
    c. Tests and Inventories
    d. Activities and Work Experience

G. Exploring Occupations
1. Studying Occupational Requirements and Trends
    a. Occupational Classifications
        (1) Career Clusters (US Office of Education)
        (2) Occupational Categories (US Dept. Labor/Census Bureau)
        (3) Standard Industrial Classification (SIC)
    b. Education and Training Required
    c. Job Requirements and Opportunities
    d. Working Conditions
    e. Requirements for Job Entry and Advancement
    f. Occupational Trends
2. Studying Occupational Information
    a. Library Resources
    b. Professional or Trade Associations
    c. Counselors
    d. Guest Speakers/Field Trips
    e. Teachers at All Levels
    f. Other
3. Studying Educational Opportunities
    a. High School/AVS
    b. Trade and Technical Schools
    c. Community College/University
    d. Military
    e. Apprenticeship and On-The-Job Training
    f. Other
4. Exploring Potential Occupations
    a. Papers/Reports
    b. Shadowing
    c. Field Trips
    d. Part-Time/Summer Jobs
    e. Audio-Visual Media
    f. Other
5. Preparing for the First Job
    a. Locate Job Opportunities
    b. Write Resume
    c. Secure References
    d. Complete Job Application
    e. Interview for Job
6. Keeping A Job
    a. Human Relations
    b. Good Work Habits
    c. Personal Hygiene
    d. Job Enhancement
    e. Other

- H. Computers
  - 1. Overview of Computers
    - a. Definition Characteristics
      - (1) Perform All Operations Electronically
      - (2) Have an Internal Storage Capability
      - (3) Receive Operational Instructions From Stored Programs
      - (4) Modify Programs and Executions by Making Logical Decisions
    - b. Types of Computers
      - (1) Analog/Digital/Hybrid
      - (2) Super/Mainframe/Mini/Micro
    - c. Codes for Computers
      - (1) Bits & Bytes
      - (2) ASCII
      - (3) EBCDIC
    - d. Functions of Computers
      - (1) Input
      - (2) Process/Calculate/Control
      - (3) Store/Retrieve
      - (4) Output
  - 2. History and Development of Computers/Timeline
  - 3. Hardware
    - a. Input Devices
      - (1) Keyboard
      - (2) Card Readers
      - (3) Magnetic Character Recognition
      - (4) Optical Character Recognition
      - (5) Light Pen
      - (6) Joystick
      - (7) Digitizer
      - (8) Trackball
      - (9) Voice Recognition
      - (10) Mouse
      - (11) Page Scanner
      - (12) Input Devices for the Handicapped
        - (a) Large Keypads
        - (b) Voice Input Devices
        - (c) Pointers for Motor Control
    - b. Processing Devices
      - (1) Central Processing Unit
        - (a) Arithmetic-Logic Unit
        - (b) Control Unit
        - (c) Memory (RAM/ROM)
      - (2) Auxiliary Boards
        - (a) Memory
        - (b) Co-Processors
        - (c) Modems
        - (d) Interface
    - c. Storage Media
      - (1) Magnetic Tape
      - (2) Diskette
      - (3) Hard Disk
      - (4) Optical Storage
    - d. Output Devices
      - (1) Printers

- (a) Dot Matrix
- (b) Ink Jet
- (c) Thermal Transfer
- (d) Daisy Wheel
- (e) Laser
- (f) Flatbed/Drum Plotters
- (g) Microfilm

(2) Monitors
  - (a) Cathode Ray Tube
  - (b) Matrix-Type Display

(3) Audio Speakers

(4) Equipment Control Signals

e. Care and Handling of Hardware

4. Software
  - a. Types
    - (1) Operating System
    - (2) Application
      - (a) Commercial
      - (b) Self-Written
  - b. Program Languages
    - (1) Machine
    - (2) Symbolic
    - (3) High-Level Programming
      - (a) BASIC
      - (b) COBOL
      - (c) FORTRAN
      - (d) LOGO
      - (e) PASCAL
  - c. Flow Chart
  - d. Care and Handling of Software
  - e. Copyright Laws
5. Selected Applications
  - a. Computer Numerical Control (CNC)
  - b. Robots
  - c. Computer Aided Design/Drafting (CAD)
  - d. Production Planning (CAPP)
  - e. Automated Assembly
  - f. Statistical Quality Control (SQC)
  - g. Inventory/Delivery Scheduling (JIT)
  - h. Computer Integrated Manufacturing (CIM)
  - i. Security
  - j. Environmental Control
  - k. Word Processing
  - l. Spreadsheets
  - m. Charts/Graphs
  - n. Data Base
  - o. Education (CAI)
  - p. Games
  - q. Traffic Control
  - r. Defense
  - s. Navigation Control
  - t. Medical Monitoring
  - u. Medical Diagnosing
  - v. Electronic Mail

Lesson Title: Fundamentals of Measurement

Unit Scope: This **unit** is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn the fundamental concepts and skills of the metric, customary, and special systems of measurement which will have diverse applications in activities of future lessons.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. State at least four reasons why measurement is needed.
2. Identify different materials that require different measuring devices.
3. Name two systems of measurement and give examples of each.
4. List and explain the major units of measure used in the metric system.
5. List and explain the major units of measure used in the customary (English) system.
6. List and apply to given problems the basic prefixes in the metric system.
7. Approximate conversions between the metric and customary (English) units of measurement.
8. Measure length accurately to l/16 inch and/or 1 mm.
9. Measure angles accurately to one degree.
10. State or select from a list at least three reasons for standardization in society.
11. Properly use layout tools for different materials.
12. Layout a part for processing.

Content Outline	Teacher Plans and Activities
II. Working With Technology A. Fundamentals of Measurement 1. Reasons for Measuring a. Describe an Object b. Describe a Quantity c. Construct an Object d. Control an Object	Make reading assignment. Organize small groups of various sized students and prepare each group to select and research an early unit of measure based on the human body. Provide worksheet for each student to record measurements, compare measurements within and among groups, and discuss the difficulties of using the human body as a measuring standard.
2. Standard Systems of Measurement a. Purposes for Standardization (1) Interchangeable Parts (2) Quantity Production of a Few Sizes (3) Fit the Human Body (4) Limit Inventory b. Standardizing Organizations (1) International Standards Organization (2) American National Standards Institute, Inc.	Discuss reasons for measuring, the purposes for standardization, and the importance of standardization in measuring.
c. Metric Units (1) History (2) Pros and Cons (3) Standard Units (4) Prefixes (5) Converting Between Units (6) Standard Format and Abbreviations (7) Reading a Full-Size Scale	Show slide presentations and lead discussion on metric measurement: history of metric measurement; pros and cons of the metric system; standard units of length, area, volume, mass and temperature; metric prefixes from kilo to milli; converting between metric units; standard format for writing metric units and abbreviations; and reading a full-size metric scale. Prepare worksheets for metric measurement.
d. Customary (English) Units (1) History (2) Human Body as Standardized Units (3) Pros and Cons (4) Standard Units (5) Converting Between Units (6) Standard Abbreviations (7) Reading a Full-Size Scale	Lead discussion on customary system of measurement: history of customary system; use of the human body in standardizing units of measurement; pros and cons of the customary system; standard units of length, area, volume, mass and temperature; converting between customary units; standard abbreviations; and reading a full-size customary scale. Prepare worksheets for customary measurement. (Gallo, Production Technology, 1986, pp. 15)
e. Unique Units for Special Purposes	Lead discussion about units of measurement for special purposes, divide class into groups of 6-7 students for group recall activity, and lead class in comparison of lists. (Bohn, et al., Energy, Power and Transp. Tech., Instr. Resource Guide, 1986, pp. 22-26)

Suggested Student Activities	References/AV/Supplies/Equipment
Working in small groups research the use of early units of measure related to the human body, such as cubit, span, digit, hand, foot, fathom, etc. Select a unit of measure based on a part of the body and measure five of the following items: length and width of front cover of the textbook, desktop, lunchroom tray, chalkboard eraser; width of front of a locker, front wall of the classroom, hall outside of the classroom; length of a Bic pen, a dollar bill; height of a 12 oz. soda can, etc. Each group should record the results for later comparison with other groups and discussion of the difficulties of using the human body as a measuring standard. (Heiner, pp. 62-63; Heiner, Teacher's Guide, p 27; Texas, Communication Systems Guide, p. 16)	Items for measurement listed in student activities, worksheet for recording measurements, chalkboard or overhead projector and transparency.
Each student will be given a one-inch strip of heavy paper of random length (from 8 to 18 inches long, all different) from which he/she will develop a personalized measuring device. (Appendix B-Lesson II-1: Linear Measurement Concept)	One-inch strips of heavy paper of random lengths from 8 to 18 inches long, paper for constructing product.
View slide presentations from Metric America Series: Historically Speaking, Measuring Length, Measuring Area, Measuring Volume, Measuring Mass, and Measuring Temperature.	Metric America Series Slide Presentations, AIMS Instructional Media, 6901 Woodley Ave., Van Nuys, CA 91406-4878.
Complete worksheets on measuring metrically: Metric Prefixes, Converting Within the Metric System, Proper Format for Writing Metric Quantities, and Reading and Recording Metric Measurements and Abbreviations.	Worksheets. Resource sheets: Measuring and Units of Measurement; Base Units of the SI Metric System; SI Unit Prefixes; Abbreviations (APPENDIX B; Starzyk, General Industrial and Technology, Student Guide, 25-26)
Complete worksheets on measuring with a customary system: Converting Within the Customary System, and Reading and Recording Customary Measurements and Abbreviations.	Worksheets. Resource sheet: Abbreviations. (APPENDIX B; Listar, Technology Activity Guide 1, 1987, pp. 7-11)
Complete worksheet on reading and approximating conversions between metric and customary systems of measurement.	Worksheets. Conversion Chart For Common Units; Approximate Customary-Metric Conversions (APPENDIX B)
Participate in a group recall activity in which each group compiles a list of units of measure for special purposes. A second goal is to include the maximum number of units not listed by other groups. Compare list with lists of other groups. (APPENDIX A)	Chalkboard or overhead projector, and transparencies.

Content Outline	Teacher Plans and Activities
II. Working With Technology **A. Fundamentals of Measurement** **2. Standard Systems of Measurement** f. Devices of Measurement	Lead class discussion about devices of measurement using a wide variety of examples and lead the class in developing a list of other measuring devices. (APPENDIX A) Prepare students for creating collage.
g. Applications of Measurement	Develop or prepare students for developing a board game, a crossword puzzle, or a card game about units and devices of measurement.
	Prepare worksheet for student activity related to measurement in various occupations. Provide list of occupations and prepare students for researching the units and devices of measurement used. Assist students in compiling reports into a booklet. (APPENDIX B)
3. Identifying the Accuracy of Measurement a. Need for Precision and Tolerance b. Specifications c. Inspection/Quality Control	Lead discussion about the meaning of accuracy, precision, tolerance, and specifications. Demonstrate the use of inspection and quality control in maintaining desired precision.
	Demonstrate the layout of parts using various stock materials, help students select a product to be manufactured, supervise students as they layout the parts for their product, and organize a quality control program to assure desired precision.

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in class recall activity compiling a list of devices of measurement. As followup activities, tour the school building looking for measuring devices, discuss with members of the community special measuring devices of the past and present, and bring to class a unique measuring device and tell the class about its application.	Chalkboard or overhead projector and transparencies; examples of measuring devices.
Create a collage of measuring devices.	Posterboard and glue for collage.
Develop a board game, a crossword puzzle or a card game related to units and devices of measurement, and/or participate in the use of the created material.	Materials for creating and/or using a board game, crossword puzzle or card game.
Select from a list of occupations, research the units and devices of measurement used, and prepare a one page picture collage and a one page written description detailing the findings. These collages and written papers could be duplicated and gathered into a class booklet.	Materials for duplicating and binding booklet; list of occupations. (Maley, Donald, ed., Math/Science/Technology Projects, American Industrial Arts Assoc. [now International Tech. Edu. Assoc.], 1914 Association Drive, Reston, VA 22091, 1985.)
Inspect a series of similar products to determine which ones meet the specified tolerance.	Products to determine specified tolerance.
Layout a part to be processed; use a steel rule or a scale to measure lengths within 1/16th inch or 1 mm and use a protractor to measure angles within 1 degree of the design size	Materials for part to be processed, steel rule or scale, and protractor. (Lindbeck, et al., General Industry and Technology, Bennett & McKnight, 1986, pp. 145-149, 263-266)
Draw a development of a one decimeter cube and fold to produce a model.	(Gallo, Production Technology, Teacher's Guide, pp. 11)
Complete vocabulary crossword puzzle for Lesson II-1.	Crossword puzzle. (APPENDIX C)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References:

Feirer, et al., Production Technology, Bennett & McKnight, 1986, pp. 47-50, 108-126.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 97.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 120-127.
Groneman, et al., General Industrial Education and Technology, Student Guide, McGraw-Hill, 1986, pp. 29-30.
Heiner, et al., People Create Technology, Davis, 1980, pp. 62-63.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 41-42, 52-57, 103-104, 142-146, 170-171, 203-204, 262-265, 332, 340-341, 348-349, 354, 359.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 329-335.

Selected Readings On Measurement

Bohn, et al., Energy, Power and Transportation Technology, Activity Guide, Bennett & McKnight, 1986, pp. 11-12.
Bohn, et al., Energy, Power and Transportation Technology, Bennett & McKnight, 1986, pp. 45-57.
Olivo, C. Thomas, Machine Tool Technology and Manufacturing Processes, C. Thomas Olivo Associates, 1987, pp. 9-14.
Starzyk, General Industry and Technology, Student Guide, Bennett and McKnight, 1986, pp. 25-26.

Revision Notes:

Lesson Title: Information Processing

Unit Scope: This unit is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn fundamental concepts and skills of gathering, selecting, organizing, storing and retrieving information.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: data, information, text data, numeric data, photographic data, drawing data, object/specimen data, transactional data, primary source, secondary source, file, chart, graph, table, retrieve.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Gather and record data using at least two methods. *ITE 3.15*
4. Organize collected data in at least two usable forms. *ITE 1.5*
5. Store and retrieve a set of data using a relevant method. *ITE 1.3, 1.4 , 3.15*
6. List or select from a list primary and secondary sources of data.
7. Complete worksheets accurately and thoroughly.
8. Increase their awareness of how a library is used for gathering and organizing data as well as for storing and retrieving information.
9. List at least ten devices used in information processing and specify their use for gathering, recording, selecting, organizing, calculating, storing or retrieving data and information.

Content Outline	**Teacher Plans and Activities**
II. Working With Technology	Make reading assignment.
B. Information Processing 1. Purposes of Information Processing a. Gather and Record New Data--Input b. Organize Data Into New Relationships--Process c. Provide a Basis for Decisions--Output d. Remember Happenings--Storage 2. Categories of Data a. Object and Specimen b. Photograph and Drawing c. Text d. Numeric e. Transactional Data	Discuss purposes of information processing, the difference between data and information, and categories of data (e.g. **numeric data** are used in calculating income tax returns, license plates, social security numbers; **text data** are used in letters, textbooks, billboard signs; **photographic data** are used in yearbooks, slide programs, picture stories as in National Geographic magazine; **drawing data** are used in architectural plans, roadway signs, engineer's sketch; **objects and specimen data** are used in.museums, exhibits, scientific experimentations, archaeological findings; **transactional data** are used in checking accounts, cash register receipts, grades, credit cards).
3. Gather and Record Data a. Techniques (1) Primary Sources (a) Survey Questionnaire/Interview	Bring examples of various techniques and devices for gathering and recording data and discuss how each aids the process of gathering and recording data as well as the technological level involved.
(b) Observation (c) Group Interaction (d) Collect Sample (e) Experimentation (f) Photograph (g) Sketch/Drawing (h) Scholarly Journal (i) Report Literature	Discuss activities in previous lessons which involved the collection of data and identify the technique used to collect and record those data. Prepare students for additional activities in data collection if needed.
(j) Newsletter (k) Other (2) Secondary Sources (a) Abstract (b) Review (c) Reference Book (d) Manual (e) Other	Discuss school and community problems or events worthy of recognition which may be effectively portrayed with photographic data and prepare students for related assignment.
b. Devices (1) Simple Writing Tools (a) Chalk/Slate/Chalk board (b) Pen/Pencil/Paper	Demonstrate the keyboarding of text data on a typewriter or computer.
(2) Typewriter/Dictating Machine (3) Copying/Printing Machine (4) Computer/CAD (5) Other	

Suggested Student Activities	References/AV/Supplies/Equipment
Read the assigned textbook material related to each concept introduced.	
Participate in discussion providing examples of the use of categories of data in making decisions in our lives. Bring unique examples of data and participate in a group to develop a display of these examples.	Bulletin board space for displays.
Gather survey data using a questionnaire or an interview, such as was suggested in Lesson I-3 or Lesson II-3.	Examples of techniques and devices for gathering and recording data.
Gather technical data using scholarly journals, report literature, abstracts and/or reviews, such as suggested in Lesson I-3 or Lesson II-3.	Paper to record data.
Gather developmental data related to products using sketches and drawings, experimentation, and group interaction, such as was suggested in Lesson I-3 or Lesson II-3.	
Using photography and other data collecting techniques, gather data related to a problem or a newsworthy activity in your school or community (such as a recycling activity, the interviews of experienced community members, or the field trips suggested in Lesson I-3). Present photos in a display to the student or city council, present the photos along with a letter to the editor to the school or community newspaper, or prepare a public photo display.	Camera, film and processing paper (if applicable), posterboard for presentation.
Record data using a typewriter or computer and duplicate copies using an office copier or duplicator, such as was suggested in Lesson I-3.	Typewriter and office duplicator or copier.

Content Outline	Teacher Plans and Activities
II. Working With Technology **B. Information Processing** 4. Select, Organize and Calculate Data	Discuss techniques and devices for selecting, organizing and calculating data.
a. Techniques (1) Chart, Graph and Table (2) File (a) Chronological Timeline (b) Category/Subject (c) Alphabetical/ Numerical	Prepare class to organize a personal file and lead them in preparing their files.
(d) Punched Card (3) Software Program	Relate the punched card deck and timeline used in Lesson I-1 and I-3 respectively to the organizing, storage and retrieval of information.
b. Devices (1) Manual Sorting/Calculating (2) Mechanical	Prepare for information processing components of Creative Problem Solving Activity. Refer to Lesson II-3.
(a) Abacus (b) Cash Register (c) Typewriter (d) Billing/Classifying/ Tabulating Machines (e) Calculator (3) Electronic Computer	Demonstrate the different technological levels involved in making calculations with numerical data using manual, mechanical and electronic methods, e.g. square roots of nonperfect squares, bookkeeping ledger totals, inventory records, etc.
5. Store and Retrieve Information a. Techniques (1) Index (2) File (3) Information Center (4) Hard Copy (book, paper, photo print) (5) Record	Lead discussion concerning the advantages and disadvantages of convenient retrieval of information. Emphasize the need for having quantities of detailed information available, (Better Business Bureau protection) as well as the increased abuse of the personal information (credit card theft).
(6) Microform (fiche card, video tape, aperture card) (7) Magnetic (VCR cassette, floppy disk, tape) (8) Computer (e.g. card catalog)	Investigate field trip opportunities related to information processing, such as a library; museum; business office of a bank, utility company, hospital, school or manufacturing firm; antique shop; business machine store, etc. Arrange for field trip, prepare class for field trip, and lead follow-up discussion.
b. Devices (1) Printing Press	
(2) Camera (3) Record Player (4) Microform Camera and Reader/Projector (5) Magnetic Recorder and Player (6) Computer	Demonstrate the construction of an information machine.

Suggested Student Activities	References/AV/Supplies/Equipment
Using one of the techniques listed in the outline organize a personal file, such as library books read, address and telephone numbers of friends, birthdates of friends and relatives, inventory of personal property, medical history, family genealogy, inventory related to collection hobby, inventory of record and tape collection, academic record, etc.	Examples of personal files; materials for developing a personal file.
Organize data using a punched card deck as suggested in Lesson I-1 and a timeline as suggested in Lesson I-3.	
Refer to Creative Problem Solving Activity in Lesson II-3 for related activities applying information processing to creative problem solving.	
Participate in a discussion related to the advantages and disadvantages of convenient retrieval of information.	
Participate in field trip related to information processing in the community, e.g. a city or regional library has devices such as the card catalog, vertical files, indexes, abstracts, scholarly journals, technical reports, microform readers/printers to store and/or retrieve information.	
Construct an information machine. (Todd, Activity Guide, pp. 57-59)	Materials and equipment for construction of information machine.
Complete vocabulary crossword puzzle for Lesson II-2.	Crossword puzzle (APPENDIX C).

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Goetsch, et al., Technology and You, Delmar, 1987, pp. 73, 153-157, 221-227, 235-255.
Hacker, et al., Living With Technology, Delmar, pp. 30-31, 71-73, 131, 264, 290-291, 442.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 111-123, 126-128.
Williams, et al., Technology At Work, South-Western, 1987, pp. 294-327.

Revision Notes:

Lesson Title: Problem Solving Techniques

Unit Scope: This **unit** is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn fundamental concepts and skills applying the general process of "the technological method"--the formal process of creative problem solving which may have varied applications in future lessons and in other daily activities. The emphasis in this lesson is on learning the general process of problem solving rather than reaching a solution to a specific problem.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: brainstorming, hitchhiking, forced relationships, design criteria.
2. Begin using the designated vocabulary terms in classroom and informal conversations.
3. Clearly identify and write a "statement of the problem" for a specified problem.
4. List the design criteria, parameters or requirements for a specified problem.
5. Utilize available resources to gain information related to a specified problem. *ITE 3.15*
6. Apply at least two formal processes for generating ideas for a specified problem.
7. List and/or sketch potential solution ideas for a specified problem. *ITE I.7, I.6, 1.9*
8. Evaluate and refine possible solution ideas for a specified problem. *ITE I.6, I.9*
9. Select, implement, and evaluate the solution for a specified problem. *ITE 1.6, I.7*
10. Participate in the development and documentation of a group problem solving activity. *ITE 1.6, 1.7, I.8, 1.9*
11. Sketch and explain a diagram of a problem solving process.
12. Complete individual informal problem solving activities by making at least five decisions related to options in technological activities. (such as selecting the materials, choosing the separation and/or shaping processes, identifying the assembly processes, specifying the finishing methods, etc.). *ITE 1.8, 1.9*

Content Outline	Teacher Plans and Activities
II. Working With Technology	Make reading assignment.
C. Problem Solving Techniques-- "The Technological Method" 1. Formal Problem Solving Processes a. Identify and State Problem b. Gather Known Information c. Propose All Possible Solutions (1) Brainstorming (2) Forced Relationships (3) Others	Set up the course and prepare students to creatively solve the selected transportation problems. Lead discussion in the application of problem solving in every day life, the comparison of "the scientific method" and "the technological method", the cyclical yet flexible nature in the sequence of steps in problem solving, and the importance of creativity in the problem solving process. Students may be reminded that the scientific method attempts to varify a single solution and the technological method attempts to select the best of numerous potential solutions to the problem under study. Prepare material kits for creative "ingredients" product and give demonstrations on the proper use of the available tools. Lead discussion on the variety of models representing the creative problem solving process, pointing out the similarity of the process regardless of the vocabulary or number of steps used in the model. Prepare worksheets involving the generation of creative ideas, prepare students for homework assignments throughout the lesson, and lead discussions related to the worksheets. Discuss principles of brainstorming, (1) provide common waste product for brainstorming activity, and lead brainstorming activity; (2) assign homework; and (3) guide brainstorming/hitchhikings activity.
d. Evaluate Solutions (1) Select Evaluative Criteria (2) Experiment with Ideas, Sketches and Models	Guide students through a creative problem solving process using a selected problem of interest to the students. As each step in the process is completed the group responses may be placed on a bulletin board as a model. Prepare handout on a creative problem solving model.

Suggested Student Activities	References/AV/Supplies/Equipment
Read the assigned textbook material related to each concept introduced.	Objects to be transported, such as a golf ball, an egg, a tennis ball, quarter, light bulb, bubble gum, piece of hard candy, lemon, small potato, green pepper, dinner roll, etc.
Solve transportation problems involving the transfer of an object under specified conditions. (Micklus, Odyssey of the Mind. pp. 44-45, 81)	Items to transport objects: a match, a plastic spoon, rubber band, two straws, two ball-point pens, three inches of masking tape, paper towel, twelve inches of string, legal size envelope, and piece of 8 1/2" x 11" paper.
Participate in a class discussion on the significance of creative problem solving as well as the relationship between "the scientific method" and "the technological method".	
Construct a creative "ingredients" product using designated materials and processes. (Micklus, OM-AHA!, pp. 91-93)	Miscellaneous materials for "ingredients" product, such as wire coat hanger, frozen juice can lids, small blocks of wood, leather shoestring, nails and screws, piece of cloth, glass, dowel rod, glass, and plastic, ceramic tile, film canisters, paper or cardboard, spring, cork, hinge, glue, etc. Tools for constructing "ingredients" product, such as hand drill, scissors, hammer, screwdriver, file, wire cutters, and pliers.
Participate in class discussion on creative problem solving models.	
Generate creative ideas using worksheets involving specified problems, such as forced relationships, acronyms, recaptioned cartoons, inkblot stories, geometric shape completion, etc.	Creative ideas worksheets. (APPENDIX B)
Participate in three individual brainstorming sessions by generating the maximum number of possible ideas for a specified topic: (1) in class, list uses of a common waste product, such as film canister, frozen juice lid, drinking cup, Legg's container, etc., (2) for homework, list ways to use a brick and (3) later in class, using a directed session involving hitchhiking, list types of dwellings.	Items for creating ideas in class, such as film canister, frozen juice lid, drinking cup, Legg's container, etc.
Create a solution to a selected problem using a creative problem solving process in a guided group setting. As the steps in the process are completed, place cards containing the responses to each step on a bulletin board to provide a model for further creative problem solving experiences. The problem for this process may be one of local interest to the students, such as providing a litter free parking lot, recycling glass and cans from the lunchroom or school concession stand, or advertising the activities of the week in an organized fashion, etc.	Bulletin board, chalkboard, 5x8 index cards, handout showing the specified model for a creative problem solving process. Handout on creative problem solving model.

Content Outline	Teacher Plans and Activities
II. Working With Technology **C. Problem Solving Techniques--"The Technological Method"** **1. Formal Problem Solving Processes** e. Select and Apply Best Solution (1) Make Necessary Drawings and Models (2) Develop Implementation Plan f. Evaluate Implemented Plan	Prior to class organize students into heterogeneous groups of approximately four students each for group problem solving activity. Guide the in-class discussion to identify potential problems and to select the best one for group work. Guide discussion toward a consensus statement of the problem and a consensus listing of design criteria. Then help the groups to identify research activities, to brainstorm for possible solutions, to experiment with possible solutions, to select the best solution, to prepare the written documentation, and to present the final solution to the class. Copies of these documents may be useful for future reference. Point out the importance of learning the main sequence of the process. The problem to be solved is of secondary importance. For sample format see APPENDIX A. Activities which have been used successfully with group problem solving by middle school teachers field testing this curriculum guide include: Eggcraft Robotic Arm Product Ideas For Mass Production Solar Cooker Mass Produced Toy Mousetrap Car CO2 Car Jigs and Fixtures For Mass Production Transportation Device Using Straws

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a group problem solving process which emphasizes a general sequence of steps but allows for a variety of student options within each step of the sequence. Any number of problems which have student interest may be used to teach the process with the exact number and sequence of steps varying with the problem, with the group involved, or with each exposure to the same problem. The process may be taught equally well using individual activities or group activities. The product selected should allow for both ideation (creative thinking) and evaluation (critical thinking) at several steps in the sequence.	Listar, Technology Activity Guide 1, 1987, pp. 115-159.
• Let's try working on a group problem, such as creating a new fruit juice flavor. As an entire class, consider several ideas as statements of the problem and reach a group consensus as to the best one. • For the chosen statement discuss and reach consensus about potential criteria which the final solution must include. • Break into smaller groups and identify research which is needed for the problem and distribute research tasks within the group. • Within the smaller groups brainstorm for a maximum number of possible solutions. • Complete a group discussion of the initial evaluation of each idea, experiment with various combinations of flavors, and record their findings along with additional ideas. • Draw or sketch ideas of names and/or logos for the product, analyze their advantages and disadvantages and describe to rest of the group. • Analyze the ideas presented, narrow the flavors and names/logos to the best two or three, and present them for market analysis. • Using the criteria established earlier, make a final evaluation, select the best solution and make necessary sketches or drawings. • Document the activities completed in solving this problem into a written presentation following the format of the creative problem solving model and submit to instructor. • Present the final solution to the entire class along with the rationale for its choice.	Materials for group problem, such as products for drinks as identified by the groups, cups, containers and utensils for mixing drinks,

Content Outline	Teacher Plans and Activities
II. Working With Technology **C. Problem Solving Techniques-- "The Technological Method"** **1. Formal Problem Solving Processes** g. Applications in Research and Development	Show film or slide presentation on research and development in industry. Discuss the parallelism between research and stating the problem and identifying known information, between development and generating ideas and experimenting with these potential solutions, and between engineering and documenting the final solution, building the prototype, and implementing the plan of application.
2. Informal Problem Solving Processes a. Clearly Define Problem b. Consider All Options c. Select Best Option	Point out the use of a simplified creative problem solving model in making decisions of choice in other course activities as well as in daily out-of-school activities.

Suggested Student Activities	References/AV/Supplies/Equipment
View and discuss film or slide presentation on research and development in industry.	Film or slide presentation on R & D in industry.
Observe the potential use of a simplified creative problem solving model in making decisions of choice in daily activities.	
Make decisions related to options in technological activities in Units III, IV, and V, such as selecting the power resources, planning the sequence of operations, choosing the activity or device, selecting the topic for research papers, selecting the topic for audio and/or video productions, deciding what information to include in written or oral presentations, selecting the materials, choosing the separation and/or shaping processes, identifying the assembly processes, specifying the finishing methods, etc..	
Complete vocabulary crossword puzzle for Lesson II-3.	(APPENDIX C)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. As an additional problem solving activity, a peer evaluation may be included in evaluating the individual effort toward the documented group problem solving activity.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

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Hacker, et al., Living With Technology, Delmar, 1988, pp. 56-72.
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Parnes, Sidney, The Magic of Your Mind, The Creative Education Foundation, Inc., Buffalo, NY 14222, 1981.
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Raudsepp, Eugene, et al.,More Creative Growth Games, Putnam, (University Associates Inc., 8517 Production Avenue, San Diego, CA 92121), 1980.
Shallcross, Doris J., Teaching Creative Behavior, Prentice-Hall, 1981.
Torrance, E. Paul, et al., Is Creativity Teachable?, Fastback 20, Phi Delta Kappa Educational Foundation, Bloomington, IN, 1973.

Revision Notes:

Lesson Title: Group Organization and Management

Unit Scope: This **unit** is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn fundamental concepts and skills for democratic group interaction in various classroom/laboratory settings.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: upper management, middle management, supervisor/foreman, skilled workers, operators, unskilled workers, planning, organizing, staffing, directing, controlling, coordinating, span of control, accountability, chain of command, organizational chart, stockholders, board of directors.
2. Begin using the designated vocabulary terms in classroom and informal conversations.
3. Sketch an organizational chart of a specified organization and indicate the leader and/or follower roles of each position. *ITE 6.1*
4. List two advantages each of organizing people within a group, of the group designating its leader(s), and of group member participation in committees.
5. List two advantages of providing information/communication within a group.
6. List two advantages of group rules/standard practices.
7. Differentiate or define the differences between line and staff organization.
8. List or distinguish among the various levels of management and labor.
9. List or distinguish among the functions of management.
10. List two examples each of groups where the formal leadership is appointed and is elected.
11. State the difference between responsibility and authority in group leadership.
12. Identify at least three different factors that can affect group dynamics and/or describe the advantages and disadvantages of one of those factors. *ITE 6.1*
13. List four factors that may influence the effectiveness of a group as an organization.
14. Cite an example in which the unofficial channels of communication might be as significant to a group as the official channels.
15. Apply the principles of group organization to a situation, problem or activity within the industrial technology class. *ITE 6.2 , 6.3 , 6.5*
16. Show a willingness to attempt new activities and to assist others within a group setting.

Content Outline	Teacher Plans and Activities
II. Working With Technology D. Group Organization and Management	Make reading assignments.
1. Introduction a. Need for Group Organization b. Need for Group Designation of Leader c. Need for Group Member Participation In Committees d. Need for Group Information/ Communication e. Need for Group Rules/Standard Practices (1) Organizational Manual (2) Standard Practices Manual	Organize students into groups of five members each and direct students in group problem solving activity using boxes of crayons. Lead discussion about the need for organizing groups, for selecting leadership, for information/communication, for group rules/ standard practices, and for committees. Also discuss that in the process of organizing, group members may assume various roles, such as group leader, follower, dissenter, mediator, questioner, etc.
2. Organizational Levels and Functions a. Type of Organizational Format (1) Line (2) Staff (3) Other b. Format Based on Function of Organization (1) By Activity (2) By Function (3) By Process (4) By Equipment (5) By Location (6) By Product (7) By Category of Customers c. Levels of Industrial Management/Labor (1) Upper Management (2) Middle Management (3) Supervisor/Foreman (4) Skilled Workers (5) Operators (6) Unskilled Workers d. Functions of Management (1) Planning (2) Organizing (3) Staffing (4) Directing (5) Controlling (6) Coordinating	Lead class discussion in pointing out that the organizational format chosen for a specific group should be based upon the function of the organization; that most organizations are composed of some combination of line and staff format; that industrial organizations typically have several levels of management and workers; and that management serves several functions within the organization. Show several typical organizational charts to the class and lead them in drawing an organizational chart for a specified organization. (See Unit V, Lesson 4).

Suggested Student Activities	References/AV/Supplies/Equipment
Read the assigned material related to each concept introduced.	
Participate in group problem solving activity entitled "Getting It All Together". Discuss the needs resulting from group activity, the roles assumed by group members in organizing, and the benefits of group organization. To give the students the opportunity to apply these principles of organization, this activity may be repeated later in this lesson.	Boxes of crayons, ball point pens, or pizza ingredients. "Getting It All Together" worksheet. (APPENDIX B)
Participate in class discussion on types of organizational format, levels of management/labor and functions of management.	Sample organizational charts.
Draw an organizational chart showing a well known organization, such as the school you attend, city or state government, student council, etc. (See Unit V, Lesson 4)	

Content Outline	Teacher Plans and Activities
II. Working With Technology **D. Group Organization and Management** 3. Organizational Leadership a. Appointed (1) Industry (2) Business (3) Government b. Elected (1) Labor Union (2) Service/Social Clubs (3) Government	Lead discussion related to the appointment or election of group leaders, along with typical organizations which may use election or appointment for leaders. Lead discussion on factors which influence the effectiveness of the group, such as commitment to the organization, authority/responsibility/accountability of members, formal/informal channels of communication, size of organization/span of control, educational level of members, member recognition program, etc.
4. Selected Factors Influencing the Effectiveness of a Group as an Organization a. Commitment to the Organization (1) Employee Ownership (2) Quality Circles (3) Employee Profit Sharing b. Authority/Responsibility/Accountability Within the Group (1) Legal Authority (2) Authority of Knowledge/Personality (3) Authority By Consent of Followers	Prepare the group for problem solving activity involving the design and production of twenty identical paper airplanes in a minimum amount of time. Discuss the organizational analysis worksheet and guide students in completing the worksheet. Lead class discussion on student reactions to the worksheet.
c. Formal/Informal Channels of Communication d. Size of Organization/Span of Control e. Educational Level of Members f. Recognition Program for Members g. Other	Direct students in organizing, planning and implementing an actual or simulated class party. Lead discussion related to committee management functions. The implementation of this activity may more appropriately fit with activities in a cluster unit.
	Plan student personnel organization for the class, prepare job description for each position, and implement it at any appropriate time.

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in class discussion on appointed and elected organizational leadership and the factors influencing the effectiveness of a group.	Paper, rubber cement, paper clips, stapler and staples; worksheet on organizational analysis and on paper airplane production. (APPENDIX B)
Participate in a group problem solving activity involving the design and production of twenty identical paper airplanes in a minimum amount of time. Complete the Organizational Analysis Worksheet and discuss the reactions with the entire class.	Richard Kline, The Ultimate Paper Airplane, #7307X; Yasuaki Ninomiya, Whitewings, #9377X; THE Paper Airplane Book, #8057X: Transtech Systems, 9889E Hibert St., San Diego, CA 92131; Jerry Mander, et al., The Great International Paper Airplane Book, Simon & Schuster, 1967. MacIntosh Computer Disk: The Great International Paper Airplane Construction Kit, Neo-Soft Inc., 1985, Simon & Schuster, Inc. Rockefeller Center, 1230 Avenue of the Americas, NY, NY 10020.
Participate in the organization and implementation of an actual or simulated class party. Within the designated committee identify the planning, organizing, and controlling functions of the committee. Report the findings of each committee to the entire class. Sketch an organizational chart and discuss the interaction among the committees, as well as the concepts of span of control, authority, responsibility, and communication. Consider the following committees: steering, food, decorating, entertainment, and cleanup. (Lux, et al., World of Construction, p. 22)	Chalkboard or overhead projector and projectual.
Participate in student personnel organization for the class. Positions or committees may be established as needed for any of the following functions: roll call and personnel assistant, tool monitor, materials monitor, production assistant, planning and reference library monitor, safety officer, ventilation engineer, finishing room monitor, machinery maintenance engineer, sanitation and cleanup coordinator, public relations officer, quality control officer, grievance committee, safety committee, personnel recognition committee, etc.	Organization chart for the student organization of the class; job description for each position.
Complete vocabulary crossword puzzle for Lesson II-4.	(APPENDIX C)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Readings On Group Organization and Management:

Amrine, Harold T., John A. Ritchey and Oliver S. Hulley, Manufacturing, Organization and Management, Fourth Edition, Prentice-Hall, 1982, pp. 22-61.
Dean, Harvey, R., Manufacturing: Industry and Careers, Modular Exploration of Technology Series, Prentice-Hall, 1976.
Lux, Donald G., and Willis E. Ray, Co-Directors, World of Construction, Fourth Edition, The Ohio State University Research Foundation, 1971, pp. 17-22, 123.
Lux, Donald G., and Willis E. Ray, Co-Directors, World of Manufacturing, Fourth Edition, The Ohio State University Research Foundation, 1971, pp. 23-33, 39-45.
Lux, Donald G., and Willis E. Ray, Co-Directors, World of Manufacturing, Laboratory Manual, Fourth Edition, The Ohio State University Research Foundation, 1971, pp. 140-144.

Revision Notes:

Lesson Title: Safety

Unit Scope: This **unit** is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn fundamental attitudes, concepts and procedures which will contribute to a safe working environment for self and others throughout the entire course. Additional specific safety instruction uniquely appropriate to Units III, IV, or V will be included in the content outline of the appropriate unit.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: safety regulation, personal protective equipment, potential hazard, unsafe condition, safety infraction, accident, emergency procedure, documentation.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials, and processes in classroom and informal conversations.
3. Demonstrate throughout the course an awareness of the importance of safety in regard to self, others, and the environment. *ITE 2.18*
4. Maintain a clean and orderly personal work area.
5. Identify the conditions requiring personal protective equipment and list the required items.
6. Select from a list and follow in all laboratory activities the general safety regulations applying in the laboratory. *ITE 2.18*
7. Identify correct safety practices and potential safety hazards in the laboratory and suggest precautions to prevent related accidents.
8. Identify procedures for documenting potential safety hazards, safety infractions, and accidents in the laboratory.
9. Write or describe as well as "follow" an approved emergency procedure for fire, weather, accident, and illness.

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Content Outline	Teacher Plans and Activities
II. Working With Technology	Make reading assignment.
D. Safety 1. Areas Needing Protection a. Person b. Society c. Environment 2. Personnel Protection a. Attitude and Behavior b. General Safety Hazards (1) Liquid on Floors (2) Lifting Heavy Objects (3) Horseplay in Laboratory (4) Other c. Conditions Requiring Special Personal Protective Equipment (1) Noise (2) Light Flash (3) Heat (4) Chemicals (5) Weight (6) Dust/Shavings/Debris (7) Other	Lead discussion exploring the need to protect the person, the society, and the environment. Point out the importance of personal respect toward self, society, and environment as it relates to attitudes that lead to safe practices. Survey the classroom and laboratory for correct safety practices. Discuss with the class general conditions within the classroom and laboratory which may become safety hazards. Lead the class in brainstorming those special conditions which require personal protective equipment. Prepare a worksheet related to safety in the classroom and laboratory. Safety instruction related to specific machines should be included at that point in the course when the machine is first used by students. Demonstrate proper use of various types of fire extinguishers and prepare activity for students to extinguish a fire. USE EXTREME CAUTION WITH THIS ACTIVITY.
3. Written Safety Regulations a. Laboratory Inspections b. State Requirements c. OSHA 4. Reports and Inspections a. Potential Hazards b. Unsafe Conditions or Practices c. Accidents d. Documentation	Lead discussion on written safety regulations and reports and inspections. Consider the appointment or election of a student laboratory safety inspector and orient the individual to regularly complete laboratory safety inspections. Discuss the need for written safety regulations and show examples of written safety regulations. Post safety regulations for classroom and lab, show location of emergency equipment, and prepare safety test and pledge. Secure and show filmstrips/cassette presentations related to safety in the laboratory. Discuss safety reports and inspections; inform students of the location of safety report and inspection forms; and demonstrate the proper completion of the Potential Hazard Report, Unsafe Conditions or Practices Report, and Accident Report.
5. Emergency Procedures a. Fire b. Severe Weather c. Accident or Illness d. Other	Lead discussion on emergency procedures related to fire, severe weather, and accident or illness. Ensure that students are able to follow school fire, severe weather, and accident or illness emergency procedures.

Suggested Student Activities	References/AV/Supplies/Equipment
Read the assigned textbook material related to each concept introduced.	Bowers, et al., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987. (See Selected Readings)
Participate in the class discussion and brainstorming session related to safety in the classroom and laboratory. Complete safety worksheet. (Starzyk, General Industry and Technology, pp. 28)	Worksheet on safety.
Complete vocabulary worksheet for Lesson II-5.	(APPENDIX B)
Obtain a newspaper article related to an accident, write a report explaining how the accident may have been prevented (attach the newspaper article to the report).	
In groups of four or five students write and plan a safety presentation to be video taped as an activity in Lesson IV-9.	
Extinguish a fire with a fire extinguisher.	Fire extinguisher, container for fire control.
Participate in discussion on written safety regulations and reports and inspections. Identify where the safety regulations for the classroom and laboratory are posted, pass a written test on these general safety regulations and sign safety commitment.	Written classroom and laboratory safety regulations, safety pledge sheet, and emergency equipment, such as fire extinguishers and eye wash solutions. (Groneman, General Industrial Education & Technology, Study Guide, p. 7; Lab Safety Supply, P. O. Box 1368, Janesville, WI 53547)
View filmstrip or video tape on general safety in the laboratory.	Filmstrips/cassette tape presentations, such as "Safety in the Shop--General", "Developing Shop Safety", "Practicing Safety", "The Safety Programs", or "On Guard". All available from Career Aids, 20417 Nordhoff St. Dept. 1A, Chatsworth, CA 91311.
Complete Potential Hazard, Unsafe Conditions/Practices, and Accident Reports.	Overhead transparencies of various report forms.
Complete home valuables/fire safety inspection worksheet, suggest plan for corrections, and develop and practice evacuation procedures.	Home valuables/fire safety inspection worksheet.
Participate in a class discussion and follow school fire, severe weather, and accident or illness procedures in simulated or actual situations.	Refer to student handbook of the school.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's ability to follow safe practices at all times as he/she participates in and completes the activities planned for this lesson and all future lessons.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References:

Bame, et al., Exploring Technology, Davis, 1980, pp. 129-130.
Feirer, et al., Production Technology, Bennett and McKnight, 1986, pp. 88-90.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 281, 413, 517-518.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 60-62, 68, 112, 118, 126-127, 152, 155, 159, 163, 167-168, 174, 183, 187, 190-192, 202, 212, 214, 216-217, 223, 225, 228, 239-240, 247, 274-275, 278, 283, 285, 292, 300, 328, 335, 374, 401.
Starzyk, General Industry and Technology, Student Guide, Bennett and McKnight, 1986, pp. 10, 28.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 148, 185, 284.
Williams, et al., Technology At Work, South-Western, 1987, pp. 178.

Selected Readings On Safety

Bowers, et al., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, pp. ETE-33-A to ETE-85-A. (Available through Instructional Materials Laboratory, University of Missouri-Columbia.).
Division of Career and Adult Education, Vocational Safety Guide, Missouri Department of Elementary and Secondary Education, 1981.
Industrial Commission of Ohio, Industrial Arts & Vocational Education Safety Manual, The Industrial Commission of Ohio, Division of Safety and Hygiene, 2325 W. Fifth Avenue, Columbus, OH 43204, no date.
Occupational Safety and Health Administration, Concepts and Techniques of Machine Safeguarding, U.S. Department of Labor, 1980.
Personal Safety, Milliken Publishing Company, St. Louis, MO., 1980(?). (Transparencies/Masters.)

Revision Notes:

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Lesson Title: Understanding Work/Yourself

Unit Scope: This **unit** is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn fundamental concepts about work in our society and assess personal interests, abilities, and goals.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: personal characteristics, ability, interest, goals, work ethic.
2. Begin using the designated vocabulary terms in classroom and informal conversations.
3. State or select from a list four reasons why people work.
4. State or select from a list four factors used in defining work.
5. State or select from a list at least six concepts underlying the work ethic.
6. State what work means to him/her personally.
7. State or choose from a list three categories of personal characteristics which are significant to job selection. *ITE 2.15*
8. Identify or choose from lists at least two abilities, two interests, and two goals which he/she possesses. *ITE 2.15*
9. Identify or select from a list sources of information related to his/her abilities and interests.
10. Identify or select from a list his/her preference of type of job, type of co-worker, and geographic location.

Content Outline	Teacher Plans and Activities
II. Working With Technology	
F. Understanding Work/Yourself	Make reading assignment.
1. Understanding the Meaning of Work	
a. Why Do We Work?	
(1) Income	Assign homework related to student reaction to why people work and a definition of work.
(2) Activity	
(3) Respect	
(4) Social Contact	Categorize and tabulate the student homework responses and lead discussion on why people work, factors defining work, and concepts of the work ethic.
(5) Creative Expression	
b. Factors Defining Work	
(1) Continuous	
(2) Productive--Goods/Services	
(3) Efficient	
(4) Intrinsic/Extrinsic Purpose	
(5) Physical/Mental Exertion	
(6) Regularly Scheduled Basis	
(7) Sociological Relationships	
(8) Involves Some Constraint	
c. Concepts of Work Ethic	
(1) All Honest Work Possesses Worth	
(2) Excellence is Rewarded in Any Occupation	
(3) One Should Always Strive to Do His/Her Best	
(4) Less Than Best Leads to Self-Dissatisfaction	
(5) One's Contribution to Society Is Largely Through Work	
(6) Work Brings Intrinsic and/or Extrinsic Rewards	
(7) Advocates of a Work Ethic Prefer to Work	
(8) Personal Pride Is Largely Work Related	
2. Understanding Yourself	Assign Who Am I? Questionnaire as homework.
a. Personal Abilities, Interests, and Goals	Lead class discussion on the importance of knowing yourself in career development; on how to identify personal abilities, interests and goals; on how geographic preferences relate to careers; on the effect of educational preparation and flexibility on careers; and on how preference for certain types of jobs and types of co-workers affects career choice.
b. Geographic Preferences	
c. Educational Preparation and Flexibility	
d. Preferences for Type of Job and Co-Workers	
3. Sources of Information	
a. Observations by Self and Others	Lead class discussion on observations of self and others, school classes and grades, tests and inventories, and activities and work experience as sources of information about self. Assign Personal Interest Inventory.
b. School Classes and Grades	
c. Tests and Inventories	
d. Activities and Work Experience	

Suggested Student Activities	References/AV/Supplies/Equipment
Read material related to understanding work/yourself.	NOTE: Students may prepare a personal career folder for compiling information gathered in Lessons II-6 and II-7.
For homework list reasons why you think people work and write a definition for work.	
Participate in a class discussion about why people work, factors which make up a definition for work, and the basic concepts of a work ethic.	
Complete Who Am I? Questionnaire related to personal abilities, interests, and goals; geographic preferences, educational interests, job interests, school classes, and activities.	Who Am I? Questionnaire (APPENDIX B). Canfield, et al., 100 Ways to Enhance Self Concept in the Classroom, Prentice-Hall, 1976, pp. 25, 47, 133, 211, 226; Lindbeck, et al., General Industry and Technology, Bennett & McKnight, 1986, pp. 424-425; Feirer, et al., Production Technology, Bennett & McKnight, 1986, pp. 373.
Participate in class discussion about understanding yourself and sources of information.	
Complete Personal Interest Inventory and write down any relationships that are identified.	Personal Interest Inventory. (APPENDIX B)
Complete vocabulary crossword puzzle for Lesson II-6.	Crossword puzzle. (APPENDIX C)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References:

Bame, et al., Exploring Technology, Davis, 1980, pp. 24-25, 274.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 395-398, 404-409.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 423-425.

Selected Readings On Work/Yourself

Kazanas, et al., The Meaning and Value of Work, Information Series No.71, VT 020 914, ERIC Clearing House on Vocational and Technical Education, The Center for Vocational and Technical Education, The Ohio State University, 1960 Kenny Road, Columbus, OH 43210, 1973.
Worthington, Robert M., Careers: An Overview, Modular Exploration of Technology Series, Prentice-Hall, Inc., 1977.

Revision Notes:

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Lesson Title: Exploring Occupations

Unit Scope: This **unit** is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn fundamental concepts and skills related to occupational classifications and requirements, occupational and educational opportunities, and initial job acquisition.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Identify the advantages and disadvantages of selected occupations from his/her viewpoint.
2. Identify job titles that best match his/her interests, aptitudes, and aspirations. *ITE 2.15*
3. State or select from a list the types of information needed to select a job.
4. Select high school courses which may meet his/her present occupational interests.
5. Identify at least six factors that affect working conditions.
6. Describe the difference between "career education" and "job training".
7. Match from a list or state occupational groups included in each of the job classifications or clusters. *ITE 2.14, 2.16*
8. Outline or order a list of the usual steps for getting a job.
9. State five sources of occupational information.
10. Search the available sources of occupational information and document the findings for specified occupations.
11. Complete a simple job application.
12. Select from a list characteristics necessary for retaining a job.
13. List at least three resources for obtaining information on available job opportunities.
14. Identify two jobs which have been created and two which have disappeared because of advancements in technology.

Content Outline

II. Working with Technology

- G. Exploring Occupations
  - 1. Studying Occupational Requirements and Trends
    - a. Occupational Classifications
      - (1) Career Clusters (USOE)
      - (2) Occupational Categories (Dept Labor/Census Bur)
      - (3) Standard Industrial Classification (SIC)
    - b. Education and Training Required
    - c. Job Requirements and Opportunities
    - d. Working Conditions
    - e. Requirements for Job Entry and Advancement
    - f. Occupational Trends
  - 2. Studying Occupational Information
    - a. Library Resources
    - b. Professional/Trade Associations
    - c. Counselors
    - d. Guest Speakers/Field Trips
    - e. Teachers at All Levels
  - 3. Studying Educational Opportunities
    - a. High School/AVS
    - b. Trade and Technical Schools
    - c. Community College/University
    - d. Military
    - e. Apprenticeship and On-The-Job Training
    - f. Other
  - 4. Exploring Potential Occupations
    - a. Papers/Reports
    - b. Shadowing
    - c. Field Trips
    - d. Part-Time/Summer Jobs
    - e. Audio-Visual Media
    - f. Other
  - 5. Preparing for the First Job
    - a. Locate Job Opportunities
    - b. Write Resume
    - c. Secure References
    - d. Complete Job Application
    - e. Interview for Job
  - 6. Keeping A Job
    - a. Human Relations
    - b. Good Work Habits
    - c. Personal Hygiene
    - d. Job Enhancement
    - e. Other

Teacher Plans and Activities

Make reading assignments related to exploring occupations.

Lead class discussion related to matching the interests and abilities of individuals with occupational requirements and trends.

Lead class discussion on occupational classifications, job requirements and opportunities, education and training requirements, working conditions, requirements for job entry and advancement, occupational trends, and sources of occupational information. Show location of sources of occupational information.

Prepare students to view computer disk, "Expectations on the Job", and lead follow-up discussion.

Prepare students to complete Occupational Study Report and discuss the use of the findings. Discuss the completed individual reports with each student.

Lead discussion providing examples of home and community activities and resources helpful for gaining occupational information and experience.

Lead discussion in the procedure for securing a job, including locating job opportunities, writing a resume, securing permission for references, completing a job application, and interviewing for a job.

Demonstrate how to complete a job application form, emphasizing the importance of providing complete and accurate information, of writing neatly and legibly, and of using correct spelling and grammar.

Lead discussion on how to keep a job and prepare students for exercise in "Keeping a Job Now That You Have It".

Suggested Student Activities	References/AV/Supplies/Equipment
Read the assigned material related to exploring occupations.	
Identify at least three occupational areas that seem to match the interests and abilities noted on the Personal Interest Inventory and Who Am I? Questionnaire from Lesson II-6.	Personal Interest Inventory and Who Am I? Questionnaire worksheets from Lesson II-6. Heiner, People Create Technology, Activity Manual, 1980, pp. 13-14.
Participate in class discussion on occupational classifications, job requirements and opportunities, education and training requirements, working conditions, requirements for job entry and advancement, occupational trends, and sources of occupational information.	References on Occupations: US Dept. of Labor, Dictionary of Occupational Titles, and Occupational Outlook Handbook; Science Research Associates, Handbook of Job Facts.
View computer disk "Expectations on the Job".	Computer disk, "Expectations on the Job", from Career Aids, 20417 Nordhoff Street, Dept. 1A, Chatsworth, CA 91311.
Complete the Occupational Study Report. Discuss the completed Report with at least one other person whose opinion is valued, such as teacher, counselor, parents, or close friend and place the Report in the personal career folder.	Occupational Study Report worksheet (APPENDIX B).
Discuss possible home and community experiences for gaining occupational information.	
Participate in discussion on the procedure for securing a job, including locating job opportunities, writing a resume, securing permission for references, completing a job application, and interviewing for the job.	
View transparencies and/or computer disk. Complete a simplified job application form and the accompanying affirmative action form. Submit them to your teacher..	Simplified job application form (APPENDIX B); Getting the Job and Keeping the Job, transparencies/masters, by Milliken Publishing Company, St. Louis, MO.; computer disk, "Filling Out Job Applications", from Career Aids, 20417 Nordhoff Street, Dept. 1A, Chatsworth, CA 91311.
Participate in discussion on how to keep a job and complete exercises in "Keeping a Job Now That You Have It".	Exercises in "Keeping a Job Now That You Have It". Available with disk, "Expectations on the Job", listed above.
Complete vocabulary worksheet for Lesson II-7.	Worksheet. (APPENDIX B)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References:

Bame, et al., Exploring Technology, Davis, 1980, pp. 60-62, 124-128, 134-137, 170-172, 224-226, 253.
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Revision Notes:

Lesson Title: Computers

Unit Scope: This **unit** is designed to provide students with universal concepts and skills necessary to work with many aspects of technology. As distributed lessons, it is suggested that introductory features of each lesson be taught as distinct topics, while other features may be integrated as needed throughout the course. Through this **lesson** each student will learn fundamental concepts related to the development and applications of computer technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: software, hardware, memory.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List four functions of a computer and give an example of each.
4. List eight computer input devices and designate those available in the school.
5. List five computer storage devices and indicate which ones are available in the school. *ITE 1.3 , 1.4, 1.5*
6. List three computer output devices and indicate which ones are available in the school. *ITE 1.4*
7. Apply principles related to the proper care and handling of hardware and software.
8. Be aware that copyright laws apply to computer software.
9. Cite ten examples of applications of computers in our society.
10. Input, process, store, and output data on a computer using selected software. *ITE 1.4, 1.5*
11. List or select from a list the hardware needed for a typical microcomputer system. *ITE 3.14, 3.15, 4.18 , 5.20*

Content Outline

II. Working With Technology
    H. Computers
        1. Overview of Computers
            a. Definition Characteristics
                (1) Perform All Operations Electronically
                (2) Have an Internal Storage Capability
                (3) Receive Operational Instructions From Stored Programs
                (4) Modify Programs and Executions by Making Logical Decisions
            b. Types of Computers
                (1) Analog/Digital/Hybrid
                (2) Super/Mainframe/Mini/Micro
            c. Codes for Computers
                (1) Bits & Bytes
                (2) ASCII
                (3) EBCDIC
            d. Functions of Computers
                (1) Input
                (2) Process/Calculate/Control
                (3) Store/Retrieve
                (4) Output

        2. History and Development of Computers/Timeline
        3. Hardware
            a. Input Devices
                (1) Keyboard
                (2) Card Readers
                (3) Magnetic Character Recognition
                (4) Optical Character Recognition
                (5) Light Pen
                (6) Joystick
                (7) Digitizer
                (8) Trackball
                (9) Voice Recognition
                (10) Mouse
                (11) Page Scanner
                (12) Input Devices for the Handicapped
                    (a) Large Keypads
                    (b) Voice Input Devices
                    (c) Pointers for Motor Control

Teacher Plans and Activities

Make reading assignments.

Lead class discussion related to the components of a definition of a computer; bits and bytes for computers; and the relationships of the functions of the computer to its major components. (For generations of computers see APPENDIX A)

Lead discussion prior to and following film or video tape on how computers operate.

Arrange for and prepare the class for a field trip to a local computer store or to a local computer classroom which would show a complete computer system including input, processing, storage and output, and which would show the internal circuit-board technology.

Prepare a list of inventors/developers and topics related to computers to be used as subjects for one or two-page papers. Lead students in checking the timelines of technology for events and individuals significant to computer technology. After the papers have been written, lead a class discussion related to inventors and inventions significant to the present day use of computers; make appropriate additions to the timelines.

Prepare name cards for the various input devices, processing devices (central processing unit and memory only), storage devices, and output devices along with proper headings for a matching activity. Lead students in individual or small group activity using a bulletin board or desktop.

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in class discussion related to the components of a definition of a computer; bits and bytes for computers; and the relationships of the functions of a computer to its major components.	Starzyk, General Industry and Technology, Student Guide, pp. 15-16.
View a film or a video tape related to how computers operate or complete the beginners tutorial on the operation of an available personal computer.	
Participate in a field trip to a local computer store or to a local computer classroom which would show a complete computer system including input, processing, storage, and output, and which would show the internal circuit-board technology.	
Check the timelines of technology prepared in Unit I, Lesson 3 for significant individuals and invents related to computer technology. From a list of inventors/developers and topics related to computers, choose a subject for a one or two-page paper. Use at least two resources to provide information for the paper. Using the findings of the paper, participate in a class discussion related to inventors and inventions significant to the present day use of computers and make appropriate additions to the timelines.	List of inventors/developers and topics related to computers.
Participate in a matching activity in which the names of various input devices,processing devices (central processing unit and memory only), storage devices, and output devices are matched with their proper headings.	Bulletin board or desktop space; name cards; and input, processing, storage and output headings.

Content Outline

- **II. Working With Technology**
  - **H. Computers**
    - **3. Hardware**
      - b. Processing Devices
        - (1) Central Processing Unit
          - (a) Arithmetic-Logic Unit
          - (b) Control Unit
          - (c) Memory (RAM/ROM)
        - (2) Auxiliary Boards
          - (a) Memory
          - (b) Co-Processors
          - (c) Modems
          - (d) Interface
      - c. Storage Media
        - (1) Magnetic Tape
        - (2) Diskette
        - (3) Hard Disk
        - (4) Optical Storage
      - d. Output Devices
        - (1) Printers
          - (a) Dot Matrix
          - (b) Ink Jet
          - (c) Thermal Transfer
          - (d) Daisy Wheel
          - (e) Laser
          - (f) Flatbed/Drum Plotters
          - (g) Microfilm
        - (2) Monitors
          - (a) Cathode Ray Tube
          - (b) Matrix-Type Display
        - (3) Audio Speakers
        - (4) Equipment Control Signals
      - e. Care and Handling of Hardware
    - 4. Software
      - a. Types
        - (1) Operating System
        - (2) Application
          - (a) Commercial
          - (b) Self-Written
      - b. Program Languages
        - (1) Machine
        - (2) Symbolic
        - (3) High-Level Programming
          - (a) BASIC
          - (b) COBOL
          - (c) FORTRAN
          - (d) LOGO
          - (e) PASCAL
      - c. Flow Chart
      - d. Care and Handling of Software
      - e. Copyright Laws

Teacher Plans and Activities

Demonstrate the input, processing, storage and output functions of the computer.

If computers are available for students to complete tutorials or other computer activities, such as drawings, word processing, data processing, games, etc., provide the necessary tutorials or application programs and storage disks.

Demonstrate the safe and proper care and handling of hardware; emphasize proper keyboard technique.

Prepare copies of a printout of a computer program which uses a well-known language, such as BASIC or LOGO. Lead students to observe the similarity between the language used and familiar written English.

Demonstrate the safe and proper care and handling of software.

Lead discussion related to the application of copyright laws to computer software.

Suggested Student Activities	References/AV/Supplies/Equipment
View a demonstration of the input, processing, storage and output functions of a computer system; complete a tutorial related to the above functions; or complete an activity which incorporates the above functions. (The hands-on activities are preferred if adequate machines and time are available.)	Computer(s); tutorial software or software for other activity; printer.
Apply safe and proper care and handling of hardware; apply proper keyboarding technique.	Written safety regulations and proper care and handling procedures for hardware and software.
Examine a printout of a computer program which uses a well known language, such as BASIC or LOGO. Observe the similarity between the language used and familiar written English.	Printout of a computer program, such as BASIC or LOGO.
Apply safe and proper care and handling of software.	
Participate in discussion related to the application of copyright laws to computer software.	

Content Outline

- **II. Working With Technology**
  - **H. Computers**
    - 5. Selected Applications
      - a. Computer Numerical Control (CNC)
      - b. Robots
      - c. Computer Aided Design/ Drafting (CADD)
      - d. Production Planning (CAPP)
      - e. Automated Assembly
      - f. Statistical Quality Control (SQC)
      - g. Inventory/Delivery Schedulingz (JIT)
      - h. Computer Integrated Manufacturing (CIM)
      - i. Security
      - j. Environmental Control
      - k. Word Processing
      - l. Spreadsheets
      - m. Charts/Graphs
      - n. Data Base
      - o. Education (CAI)
      - p. Games
      - q. Traffic Control
      - r. Defense
      - s. Navigation Control
      - t. Medical Monitoring
      - u. Medical Diagnosing
      - v. Electronic Mail

Teacher Plans and Activities

Lead a class discussion about applications of computers in today's society.

Arrange for a field trip to observe the uses of computers within the school building. Be prepared to point out the input, processing, storage, and output functions and devices used.

Obtain a film or video tape related to computer applications in society. Prepare class for film or video tape and conduct followup discussion.

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion in which each class member adds to a master list of computer applications in today's society. The list may be presented on a chalkboard or overhead transparency.	Chalkboard or overhead projector and transparency.
Participate in a field trip within the school building observing for computer applications. Discuss with the appropriate users or with the teacher the input, processing, storage and output functions and devices.	
View film or video tape related to computer applications.	"Computer: Tool for the Future", National Geographic Educational Service, c/o Karol Media, 22 Riverview Drive, Wayne, NJ 07470 (film or video, 23 minutes, free preview, three day rental $35.00); "Computer Magic", Cinemagic Productions, 537 Jones Street, No. 898, San Francisco, CA 94102 (60 minutes, VHS or Beta, $39.95 purchase).
Complete vocabulary crossword puzzle for Lesson II-8.	Crossword puzzle. (APPENDIX C)

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

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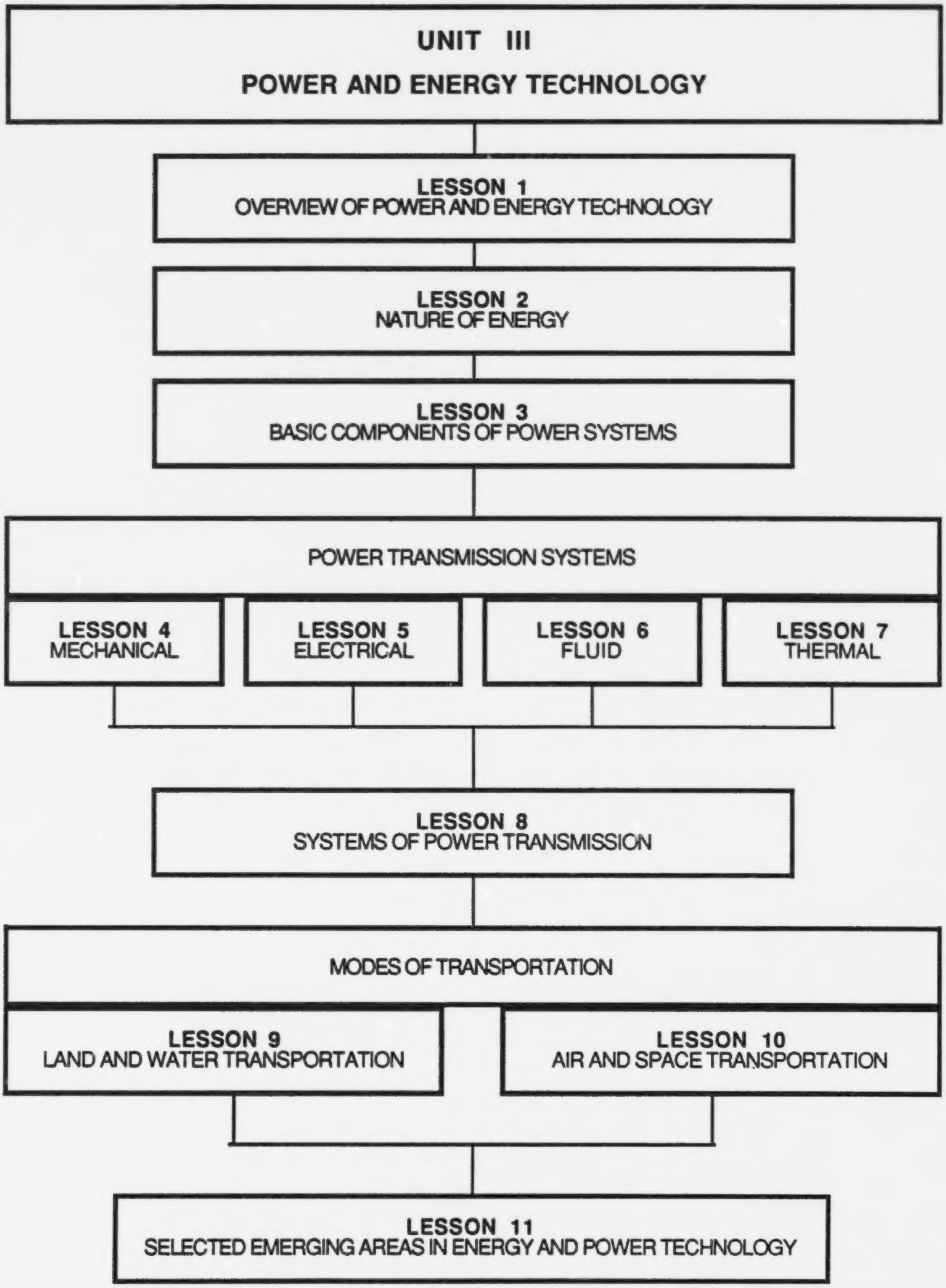
Revision Notes:


UNIT III
POWER AND ENERGY TECHNOLOGY
LESSON 1
OVERVIEW OF POWER AND ENERGY TECHNOLOGY
LESSON 2
NATURE OF ENERGY
LESSON 3
BASIC COMPONENTS OF POWER SYSTEMS
POWER TRANSMISSION SYSTEMS
LESSON 4
MECHANICAL
LESSON 5
ELECTRICAL
LESSON 6
FLUID
LESSON 7
THERMAL
LESSON 8
SYSTEMS OF POWER TRANSMISSION
MODES OF TRANSPORTATION
LESSON 9
LAND AND WATER TRANSPORTATION
LESSON 10
AIR AND SPACE TRANSPORTATION
LESSON 11
SELECTED EMERGING AREAS IN ENERGY AND POWER TECHNOLOGY

III. Energy and Power Technology

A. Overview of Energy and Power Technology
  1. Definitions
    a. Force
    b. Work
    c. Energy
    d. Power
    e. Energy Conversion
    f. Power Transmission
    g. Load
    h. Transportation
  2. Importance of Energy and Power in Technology
  3. Energy and Power Systems Models
    a. Input--Energy Source
    b. Processing
      (1) Energy Conversion
      (2) Transmission
      (3) Control
      (4) Measurement
    c. Output
      (1) Desired Load
        (a) Motion
        (b) Heat
        (c) Light
      (2) Undesired Heat Waste
  4. Relationship of Other Curricular Areas to Energy and Power Technology
    a. Scientific Principles
    b. Mathematical Applications
    c. Social/Cultural Interaction
    d. Language Arts Applications
  5. Selected Timeline of Energy and Power Technology
    a. Prior To 1 A.D.
      (1) Human Muscle
      (2) Animal Muscle
      (3) Dugout Canoe
      (4) Wheel
      (5) Water Wheel
      (6) Archimedes Water Screw
    b. 1 A.D. To 1700 A.D.
      (1) Horse Collar and Saddle
      (2) Windmill
      (3) Lateen Sail
      (4) Magnetic Compass

- c. 1700 A.D. To 1900 A.D.
  - (1) Steam Engine
  - (2) Battery
  - (3) Steam Train
  - (4) Electromagnetism
  - (5) Water Turbine
  - (6) Bicycle
  - (7) First Oil Well Drilled
  - (8) Internal Combustion Engine
  - (9) Electric Motor
  - (10) Electrostatic Generator
  - (11) Steam Turbine
- d. 1900 A.D. To Present
  - (1) Airplane
  - (2) Liquid Fuel Rocket
  - (3) Jet Engine
  - (4) Nuclear Reactor
  - (5) Nuclear Ship
  - (6) Moon Landing
  - (7) Spacecraft

6. Special Safety Concerns
   - a. Energy and Power
     - (1) Past Records
     - (2) Potential Hazards
     - (3) Equipment Safety Guards
     - (4) Personal Protective Equipment
   - b. Transportation
     - (1) Past Records
     - (2) Potential Hazards
     - (3) Equipment Safety Guards
     - (4) Personal Protective Equipment
7. Careers
   - a. Selected Energy and Power Occupations
     - (1) Professional
       - (a) Engineer
       - (b) Scientist
       - (c) Manager
       - (d) Officers
     - (2) Technical
       - (a) Electrical Technician
       - (b) Heating/Cooling Technician
       - (c) Nuclear Technician
       - (d) Laboratory Technician
     - (3) Skilled-Labor
       - (a) Welder
       - (b) Machinist
     - (4) Semi-Skilled-Labor
       - (a) Heavy Truck Driver
       - (b) Derrick Operator
       - (c) Pipeline Worker
       - (d) Stripping Shovel Operator
       - (e) Generating Plant Operator

            (5) Service/Clerical and Sales
                (a) Heavy Equipment Mechanic
                (b) Heating/Cooling Mechanic
                (c) Service Station Attendant
                (d) Salesperson
                (e) Secretary
                (f) Clerk
        b. Selected Transportation Occupations
            (1) Professional
                (a) Manager
                (b) Design Engineer
                (c) Research Scientist
                (d) Officers
                (e) Navigator
                (f) Pilot
            (2) Technical
                (a) Computer Programmer
                (b) Instrumentation and Control Technician
                (c) Air Traffic Controller
            (3) Skilled/Semi-Skilled-Labor
                (a) Locomotive Engineer
                (b) Bus Driver
                (c) Taxicab Driver
            (4) Service/Clerical and Sales
                (a) Ticket Agent
                (b) Flight Attendant
                (c) Cargo Handler
                (d) Auto/Diesel Mechanic
                (e) Marine Equipment Mechanic
                (f) Airframe Mechanic
                (g) Secretary
                (h) Clerk
                (i) Salesperson

B. Nature of Energy
    1. Sources of Energy
        a. Natural Energy Sources
            (1) Wind
            (2) Water
            (3) Solar Thermal
            (4) Ocean Thermal
            (5) Geothermal
            (6) Human Muscle
            (7) Animal Muscle
        b. Energy Sources Requiring Refinement
            (1) Fossil Fuels
                (a) Coal
                (b) Oil
                (c) Natural Gas

        - (2) Biofuels (Biomass)
            - (a) Plants
            - (b) Wood
            - (c) Animals
            - (d) Animal Waste
            - (e) Plant Waste
            - (f) Sewage/Garbage
        - (3) Nuclear Fuels
            - (a) Uranium
            - (b) Plutonium
        - (4) Synthetic Fuels
            - (a) Synfuels (Marlstone)
            - (b) Synthesis Gas (Biomass)

2. Basic Principles of Energy
    - a. Energy Can Not Be Destroyed or Created.
    - b. Through Use, the Ability of Energy To Do Work Is Downgraded Even Though the Energy Is Not Destroyed
3. Forms of Energy
    - a. Theoretical Solar Energy Spectrum
        - (1) Atomic
        - (2) Chemical (Molecular)
        - (3) Mechanical
        - (4) Electromagnetic
        - (5) Radiant
        - (6) Cosmic
    - b. Usable Forms of Energy
        - (1) Nuclear
            - (a) Fission
            - (b) Fusion
        - (2) Thermal (Heat)
            - (a) Direct
            - (b) Converted
        - (3) Chemical
            - (a) Oxidation
            - (b) Reaction
        - (4) Motion (Mechanical)
            - (a) Simple Machines
            - (b) Complex Machines
        - (5) Electrical
            - (a) Static
            - (b) Current
        - (6) Light
            - (a) Direct
            - (b) Converted
4. States of Energy
    - a. Kinetic (In Use)
    - b. Potential (Stored For Use)
        - (1) Chemical Fuel Energy
            - (a) Biofuels
            - (b) Fossil Fuels
        - (2) Nuclear Fuel Energy

            (3) Motion Energy
                (a) Inertia (Flywheel)
                (b) Gravity (Pumped Storage)
                (c) Deformation (Spring)
            (4) Electrical Energy
                (a) Chemical (Battery)
                (b) Electrons (Capacitor)
                (c) Magnetism (Magnet)
            (5) Pressurized Fluid Energy
            (6) Thermal Mass Energy

C. Conversion of Selected Energy Forms
    1. Direct Conversion Methods/Devices
        a. Chemical to Electrical
            (1) Batteries
            (2) Fuel Cells
        b. Thermal to Electrical
            (1) Magneto-Hydrodynamic
            (2) Thermoelectric Generator
            (3) Thermoelectric Convertor
        c. Motion to Electrical
            (1) Generator
        d. Optical to Electrical
            (1) Photovoltaic Cell
        e. Electrical to Motion
            (1) Motor
        f. Fluid to Motion
            (1) Windmill
            (2) Turbine
        g. Motion to Fluid
            (1) Pump
            (2) Fan
        h. Electrical to Thermal
            (1) Heater
        i. Electrical to Optical
            (1) Light Bulb
    2. Indirect Conversion Methods/Devices
        a. Chemical to Heat to Motion
            (1) Internal Combustion Engine
            (2) External Combustion Engine
        b. Chemical to Heat to Motion to Electrical
            (1) Boiler
            (2) Furnace
        c. Nuclear to Heat to Fluid to Motion to Electrical
            (1) Nuclear Power Plant

D. Conservation of Energy Resources
    1. Renewable
        a. Wood
        b. Plants
        c. Waste By Products
        d. Animal Power
        e. Human Power
        f. Synthetic

- 2. Inexhaustible
    - a. Solar
    - b. Tidal
    - c. Wave
    - d. Wind
    - e. Geothermal
    - f. Ocean Thermal
    - g. Gravitational
    - h. Atomic Fusion
- 3. Exhaustible
    - a. Coal
    - b. Oil
    - c. Natural Gas
    - d. Uranium
    - e. Synthetic

E. Choice of Optimum Energy Source

F. Systems of Power Transmission

- 1. Basic Components of Power Transmission Systems
    - a. Energy Source
    - b. Conversion Method
    - c. Transmission Path
    - d. Control System
        - (1) Types
            - (a) Manual
            - (b) Semi-Automatic
            - (c) Automatic
        - (2) Devices
            - (a) Switches
            - (b) Valves
    - e. Measurement Units and Devices
        - (1) Units
        - (2) Types
            - (a) Manual
            - (b) Semi-Automatic
            - (c) Automatic
            - (d) Cybernetic
        - (3) Devices
            - (a) Meters
            - (b) Gauges
    - f. Output/Load
        - (1) Mechanical Applications (Motion)
        - (2) Thermal Applications (Heat)
        - (3) Light Applications (Light)
    - g. Conservation of Energy Use
        - (1) By Improved Efficiency
            - (a) Reduce Friction
            - (b) Use of Optimal Size Power System
            - (c) Use of Natural Energy Sources
            - (d) Alternate Use of Excess Heat
            - (e) Other
        - (2) By Sector
            - (a) Residential Sector
            - (b) Industrial Sector
            - (c) Transportation Sector

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- h. Impact of Power Transmission System
- 2. Mechanical Power Transmission Systems
  - a. Typical Energy Sources (Input)
    - (1) Human (Bicycle)
    - (2) Heat Engine (Automobile)
    - (3) Wind (Windmill)
  - b. Typical Conversion Methods
    - (1) Chemical to Reciprocating Motion to Rotary Motion (Human On Bicycle)
    - (2) Chemical to Thermal to Reciprocating Motion to Rotary Motion (Automobile)
    - (3) Linear Motion to Rotary Motion (Windmill)
  - c. Transmission and/or Control Techniques
    - (1) On/Off Switching
    - (2) Changing Direction
      - (a) Reversing
      - (b) Turning
      - (c) Changing One Type Of Motion For Another
    - (3) Changing Force/Speed
  - d. Transmission and/or Control Devices
    - (1) Gears
    - (2) Pulleys and Belts
    - (3) Sprockets and Chains
    - (4) Clutches
    - (5) Shafts and Couplings
    - (6) Cams
    - (7) Levers
    - (8) Governors
    - (9) Cables
  - e. Measurement
    - (1) Customary Units (Metric)
      - (a) Foot-Pound (Joule)
      - (b) Pound-Foot (Newton-Meter)
      - (c) Horsepower (Watt)
    - (2) Devices
      - (a) Torque Wrench
      - (b) Dynamometer
  - f. Scientific Principles
    - (1) Mechanical Advantage
    - (2) Simple Machines
    - (3) Friction
  - g. Typical Applications (Output)
    - (1) Transportation
      - (a) Bicycle
      - (b) Automobile
      - (c) Train
    - (2) Communication
      - (a) String &Percussion Instruments
      - (b) Camera
      - (c) Simple Printing Presses
    - (3) Manufacturing
      - (a) Machinery
      - (b) Material Handling Systems
      - (c) Heavy Equipment

- (4) Construction
  - (a) Hand Tools
  - (b) Material Handling Systems
  - (c) Heavy Equipment
- h. Conservation of Energy Use
  - (1) Friction Reduction
    - (a) Sleeve Bearings
    - (b) Anti-Friction Bearings
    - (c) Lubricant
  - (2) Optimal Size Power System
  - (3) Alternate Use of Excess Heat
  - (4) Other
- i. Impact of Mechanical Power Transmission Systems

3. Electrical Power Transmission Systems
   - a. Typical Energy Sources (Input)
     - (1) Battery (Flashlight)
     - (2) Heat Engine (Automobile Alternator)
     - (3) Falling Water (Hydroelectric Power Plant)
   - b. Typical Conversion Methods
     - (1) Chemical to Electrical to Light (Flashlight)
     - (2) Chemical to Thermal to Rotary Motion to Electrical (Alternator)
     - (3) Linear Motion to Electrical (Hydroelectric Power Plant)
   - c. Transmission and/or Control Techniques
     - (1) On/Off Switching
     - (2) Changing Direction/Polarity
     - (3) Changing Current
       - (a) Rectifying Current
       - (b) Changing Voltage
     - (4) Filtering Current/Capacitance
     - (5) Controlling Overload
     - (6) Controlling Motion
     - (7) Controlling Heat/Light
   - d. Transmission and/or Control Devices
     - (1) Conductors
     - (2) Insulators
     - (3) Semi-Conductors
     - (4) Switches
     - (5) Relays
     - (6) Transistors
     - (7) Diodes
     - (8) Transformers
     - (9) Resistors
     - (10) Variable Resistors
     - (11) Fuses
     - (12) Circuit Breakers
     - (13) Solenoids
     - (14) Motors
     - (15) Resistance Coils
     - (16) Filaments

- e. Measurement
  - (1) Units
    - (a) Ohm (Resistance)
    - (b) Volt (EMF)
    - (c) Amperage (Current)
    - (d) Watt (Electrical Power)
    - (e) Hertz (Frequency)
  - (2) Devices
    - (a) Ohmmeter
    - (b) Voltmeter
    - (c) Ammeter
    - (d) Wattmeter
    - (e) Frequency Meter
    - (f) Oscilloscope
- f. Scientific Principles
  - (1) Current
    - (a) Alternating Current
    - (b) Direct Current
  - (2) Resistance
  - (3) Voltage
  - (4) Ohm's Law
  - (5) Series Circuits
  - (6) Parallel Circuits
  - (7) Magnetism
  - (8) Electromagnetic Induction
  - (9) Frequency
  - (10 Rectification
  - (11) Capacitance
- g. Typical Applications (Output)
  - (1) Transportation
    - (a) Electric Trains
    - (b) Electric Cars
    - (c) Conveyance Systems
  - (2) Communication
    - (a) Radio/Television
    - (b) Telephone
    - (c) Satellite
  - (3) Manufacturing
    - (a) Robotics
    - (b) Laser
    - (c) Electroplating
  - (4) Construction
    - (a) Power Tools
    - (b) Material Handling
    - (c) Welding
- h. Conservation of Energy Use
- i. Impact of Electrical Power Transmission Systems

4. Fluid Power Transmission Systems
   - a. Typical Energy Sources
     - (1) Human (Hydraulic Jack)
     - (2) Electric Pump (Hydraulic Automobile Hoist)
     - (3) Heat Engine (Air Compressor)

- b. Typical Conversion Methods
  - (1) Chemical to Reciprocating Motion to Multiplied Linear Motion (Hydraulic Jack)
  - (2) Electrical to Rotary Motion to Multiplied Linear Motion (Hydraulic Automobile Hoist)
  - (3) Chemical to Thermal to Rotary Motion to Multiplied Linear Motion (Air Compressor)
- c. Transmission and/or Control Techniques
  - (1) Transferring Force
  - (2) Multiplying Force
- d. Transmission and/or Control Devices
  - (1) Fluids
  - (2) Reservoirs/Receivers
  - (3) Pumps/Compressors
  - (4) Filters
  - (5) Transmission Lines
  - (6) Control Valves
  - (7) Actuators
- e. Measurement
  - (1) Customary Units (Metric)
    - (a) Cubic Inch (Cubic Centimeter)
    - (b) Pound Per Square Inch (Pascals)
    - (c) Pounds (Newtons)
    - (d) Pound-Feet (Newton-Meters)
    - (e) Ounces (Milliliters)
  - (2) Devices
    - (a) Compound Gauge
    - (b) Regular Gauge
    - (c) Absolute Gauge
- f. Scientific Principles
  - (1) Fluid Pressure
  - (2) Vacuum
  - (3) Boyle's Law
  - (4) Charles' Law
  - (5) Hydraulics
  - (6) Pneumatics
- g. Typical Applications
  - (1) Transportation
    - (a) Pneumatic Tubes
    - (b) Pipelines
    - (c) Brake Systems
  - (2) Communication
    - (a) Pneumatic Tubes
    - (b) "Air" Musical Instruments
    - (c) Speech
  - (3) Manufacturing
    - (a) Heavy Machinery
    - (b) Tools
    - (c) Equipment
  - (4) Construction
    - (a) Heavy Machinery
    - (b) Tools
    - (c) Equipment
- h. Conservation of Energy Use

- i. Impact of Fluid Power Transmission Systems

5. Thermal Power Transmission Systems
   - a. Typical Energy Sources
     - (1) Sun (Solar Heating Systems)
     - (2) Fossil Fuel (Natural Gas Heating System)
     - (3) Electricity (Soldering Gun)
   - b. Typical Conversion Methods
     - (1) Solar Thermal to Air Thermal via Convection (Passive Solar Heating)
     - (2) Chemical to Air Thermal (Natural Gas Heating)
     - (3) Electrical to Thermal Via Conduction (Soldering Gun)
   - c. Transmission and/or Control Techniques
     - (1) Natural Conduction
     - (2) Natural Radiation
     - (3) Natural Convection
       - (a) Passive Systems
       - (b) Active Air Systems
       - (c) Active Water Systems
   - d. Transmission and/or Control Devices
     - (1) Heat Pumps
     - (2) Heat Exchangers
     - (3) Convection Chimney
     - (4) Plenum
     - (5) Heat Masses/Syncs
     - (6) Thermostat
   - e. Measurement
     - (1) Standard Units (Metric)
       - (a) British Thermal Unit (Watt/Calorie/Joule)
       - (b) Fahrenheit (Celsius)
     - (2) Devices
       - (a) Thermometer
       - (b) Pyrometer
   - f. Scientific Principles
     - (1) Conduction
     - (2) Radiation
     - (3) Convection
     - (4) Greenhouse Effect
   - g. Typical Applications
     - (1) Transportation
       - (a) Hot Air Balloon
       - (b) Temperature Gauge
       - (c) Thermostat
       - (d) Automobile Heater
     - (2) Communication
       - (a) Space Satellite
       - (b) Thermometer
       - (c) Pyrometer
     - (3) Manufacturing
       - (a) Casting Glass
       - (b) Soldering
       - (c) Welding
       - (d) Thermoforming
       - (e) Candy Making

- (4) Construction
  - (a) Heating System
  - (b) Water Heater
  - (c) Heat Pump
- h. Conservation of Energy Use
- i. Impact of Thermal Power Transmission Systems

G. Transportation

- 1. Introduction to Transportation
  - a. Modes of Transportation
    - (1) Stationary Conveyance Systems
    - (2) Land Transportation
    - (3) Water Transportation
    - (4) Air Transportation
    - (5) Space Transportation
  - b. Components of Transportation Systems
    - (1) Vehicles
      - (a) Propulsion Systems
      - (b) Control Systems
      - (c) Guidance Systems
      - (d) Suspension Systems
      - (e) Structural Systems
    - (2) Controlled Pathways
      - (a) Planning and Design
      - (b) Construction
      - (c) Management
    - (3) Support Services
      - (a) Energy Supply
      - (b) Vehicle Maintenance
      - (c) Pathway Maintenance
      - (d) Safety Assurance
      - (e) Finance of Pathways
      - (f) Regulations
      - (g) Guidance Systems
  - c. Historical Development
    - (1) Primitive Transportation
    - (2) Modern Transportation
    - (3) Transportation Trends
  - d. Analysis of Transportation Modes (Systems)
    - (1) Advantages
    - (2) Disadvantages
    - (3) Selecting Optimal Modes of Transportation
      - (a) Cost
      - (b) Time
      - (c) Distance
      - (d) Man-made Barriers
      - (e) Natural Barriers
      - (f) Type of Cargo
      - (g) Volume of Cargo
      - (h) Weight of Cargo
      - (i) Value of Cargo
      - (j) Packaging Requirements
      - (k) Handling Requirements
      - (l) Personnel Comfort
      - (m) Personnel Safety

2. Land and Water Transportation Systems
    a. Stationary Conveyance Systems
        (1) Devices To Move People
            (a) Elevators
            (b) Escalators
            (c) Personal Rapid Transit (PRTs)
            (d) Cable Cars
        (2) Devices To Move Cargo
            (a) Conveyors
            (b) Pipelines
            (c) Robots
            (d) Specialized Devices
        (3) Basic Operation Principles
        (4) Support Systems
            (a) Maintenance
            (b) Safety Assurance
    b. Land Transportation Systems
        (1) Vehicles
            (a) Automobiles
            (b) Trucks
            (c) Railroad Cars
            (d) Busses
            (e) Bicycles
            (f) Carts/Wagons
            (g) Tractors
            (h) Recreational Vehicles
            (i) Other
        (2) Controlled Pathways
            (a) Highways
            (b) Railways
            (c) Tubes
        (3) Support Systems
            (a) Energy Supply
            (b) Vehicle Maintenance
            (c) Pathway Maintenance
            (d) Safety Assurance
            (e) Finance of Pathways
            (f) Regulations
            (g) Guidance Systems
    c. Water Transportation Systems
        (1) Vehicles
            (a) Boats
            (b) Ships
            (c) Barges
            (d) Hydrofoils
            (e) Hovercrafts
            (f) Submersibles
        (2) Controlled Pathways
            (a) Inland Waterways
            (b) Sea Lanes
            (c) Canals

        (3) Support Systems
            (a) Energy Supply
            (b) Vehicle Maintenance
            (c) Pathway Maintenance
            (d) Safety Assurance
            (e) Finance of Pathways
            (f) Navigation
            (g) Regulations
3. Air and Space Transportation Systems
    a. Air Transportation Systems
        (1) Vehicles
            (a) Fixed Wing
            (b) Rotary Wing
            (c) Lighter Than Air
        (2) Controlled Pathways
            (a) Airways
            (b) Runways
            (c) Taxi Ways
        (3) Support Systems
            (a) Energy Supply
            (b) Vehicle Maintenance
            (c) Pathway Maintenance
            (d) Safety Assurance
            (e) Finance of Pathways
            (f) Regulations
            (g) Guidance Systems
    b. Space Transportation Systems
        (1) Vehicles
            (a) Manned
            (b) Unmanned
        (2) Controlled Pathways
            (a) Orbital
            (b) Sub-Orbital
        (3) Support Systems
            (a) Energy Supply
            (b) Vehicle Maintenance
            (c) Pathway Maintenance
            (d) Safety Assurance
            (e) Finance of Pathways
            (f) Regulations
            (g) Guidance Systems

H. Selected Emerging Areas
1. Energy Conversion Systems
    a. Cryogenics
    b. Solar
    c. Thermal
    d. Biomass
    e. Other

2. Systems of Power Transmission
   a. Artificial Intelligence
   b. Robotics
   c. Lasers
   d. Thermographs
   e. Fiber Optics
   f. Magnetic Levitation
   g. Superconductivity
   h. Other
3. Transportation Systems
   a. Stationary Conveyance Systems
   b. Land Vehicles
   c. Water Vehicles
   d. Aircraft
   e. Space Vehicles
   f. Aerodynamics
   g. Other
4. Potential Trends in Energy and Power Technology
   a. Increased Use of Solar Energy
   b. Increased Use of Computers
   c. Increased Environmental Consequences and Concerns
   d. Increased Recycling of Waste Materials
   e. Decrease in Use of Human and Animal Power
   f. Increase in Electrical Power
   g. Concern About Fluid Dynamics In Vehicle Design
   h. Other
5. Current Social/Cultural Issues In Energy and Power Technology
   a. Nuclear Energy/Waste
   b. Pollution/Acid Rain/Green House Effect
   c. Depletion of Fossil Fuels
   d. Standard of Living/High Energy Use
   e. Noise Pollution
   f. Auto Industry/Economy
   g. Space Rights/Pollution
   h. Space Program/Risks
   i. Robotics/Replacing Humans In the Work Place
   j. Other

Lesson Title: Overview of Energy and Power Technology

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills involving the curricular interrelationships, the historical aspects, the safety concerns, and the career opportunities in energy and power technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: force, work, energy, power, energy conversion, power transmission, load, transportation.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish among force, work, energy, and power.
4. Sketch a model of the components of a power system and a transportation system. *ITE 2.4, 4.4*
5. State the use of energy and power technology in materials and processing as well as communication technology. *ITE 4.2*
6. Cite examples of scientific principles, mathematical applications, social/cultural interaction, and language arts applications in the energy and power technology of today. *ITE 2.4, 2.7, 2.9, 2.19*
7. State the unique contribution of each selected technological development in energy and power toward the technology of that time and toward present day technology. *ITE 2.10, 2.11, 2.19*
8. State potential safety hazards in the energy and power occupations and in transportation occupations and describe equipment safety guards and personal protective equipment which have been developed to provide safer working conditions in these industries.
9. Follow in all laboratory activities the safety regulations applying in the laboratory. *ITE 2.18*
10. Select from a list of occupations those found in energy and power as well as transportation and describe the type of work involved in each occupation. *ITE 2.14, 2.15, 2.16, 2.17*
11. Match occupations in energy and power as well as transportation with the educational/skill level required for that occupation and with the classification level of that occupation. *ITE 2.14, 2.15, 2.16, 2.17*

Content Outline | **Teacher Plans and Activities**

- III. Energy and Power Technology
  - A. Overview of Energy and Power Technology
    - 1. Definitions
      - a. Force
      - b. Work
      - c. Energy
      - d. Power
      - e. Energy Conversion
      - f. Power Transmission
      - g. Load
      - h. Transportation
    - 2. Importance of Energy and Power in Technology
    - 3. Energy and Power Systems Models
      - a. Input--Energy Source
      - b. Processing
        - (1) Energy Conversion
        - (2) Transmission
        - (3) Control
        - (4) Measurement
      - c. Output
        - (1) Desired Load
          - (a) Motion
          - (b) Heat
          - (c) Light
        - (2) Undesired Heat Waste
    - 4. Relationship of Other Curricular Areas to Energy and Power Technology
      - a. Scientific Principles
      - b. Mathematical Applications
      - c. Social/Cultural Interaction
      - d. Language Arts Applications
    - 5. Selected Timeline of Energy and Power Technology
      - a. Prior To 1 A.D.
        - (1) Human Muscle
        - (2) Animal Muscle
        - (3) Dugout Canoe
        - (4) Wheel
        - (5) Water Wheel
        - (6) Archimedes Water Screw
      - b. 1 A.D. To 1700 A.D.
        - (1) Horse Collar and Saddle
        - (2) Windmill
        - (3) Lateen Sail
        - (4) Magnetic Compass

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion involving definitions related to energy and power, the importance of energy and power technology, the power system and the transportation system models, and curricular relationships related to energy and power technology.	
Sketch a systems model for a power technology system and for a transportation technology system.	
Participate in a class discussion with teachers from other curricular areas investigating possible interrelationships between the development of selected energy and power devices as well as transportation devices and the principles included in the sciences, mathematics, social sciences, and language arts curriculums of today.	Fales, Technology: Today and Tomorrow, pp. 294-295.
Participate in a small group to research significant technological developments related to energy and power technology during a selected period of time--prior to 1 A .D., 1 A.D. to 1700 A.D., 1700 A.D. to 1900 A.D., 1900 A.D. to the Present. Be prepared to discuss the findings in class.	Bame, Exploring Technology, Activity Manual, pp. 25-27.
Write a research paper of approximately three pages describing a selected significant technological development related to energy and power and its contribution to the technology of that time and to present day technology. Sketches or photos may be added to further describe the development. These papers may be compiled for a given class, duplicated, published as a booklet, and distributed to the class members. (see Unit I, Lesson 3)	Bame, Exploring Technology, Activity Manual, pp. 25-27.
View a film or video tape related to the significant technological developments in energy and power.	"Classroom Guide: The EPCOT Center Experience", pp. 18-29, EPCOT Educational Media, 500 S. Buena Vista St., Burbank, CA 91521.

Content Outline **Teacher Plans and Activities**

- **III. Energy and Power Technology**
  - **A. Overview of Energy and Power**
    - **5. Selected Timeline of Energy and Power**
      - c. 1700 A.D. To 1900 A.D.
        - (1) Steam Engine
        - (2) Battery
        - (3) Steam Train
        - (4) Electromagnetism
        - (5) Water Turbine
        - (6) Bicycle
        - (7) First Oil Well Drilled
        - (8) Internal Combustion Engine
        - (9) Electric Motor
        - (10) Electrostatic Generator
        - (11) Steam Turbine
      - d. 1900 A.D. To Present
        - (1) Airplane
        - (2) Liquid Fuel Rocket
        - (3) Jet Engine
        - (4) Nuclear Reactor
        - (5) Nuclear Ship
        - (6) Moon Landing
        - (7) Spacecraft
    - 6. Special Safety Concerns
      - a. Energy and Power
        - (1) Past Records
        - (2) Potential Hazards
        - (3) Equipment Safety Guards
        - (4) Personal Protective Equipment
      - b. Transportation
        - (1) Past Records
        - (2) Potential Hazards
        - (3) Equipment Safety Guards
        - (4) Personal Protective Equipment
    - 7. Careers
      - a. Selected Energy and Power Occupations
        - (1) Professional
          - (a) Engineer
          - (b) Scientist
          - (c) Manager
          - (d) Officers
        - (2) Technical
          - (a) Electrical Technician
          - (b) Heating/Cooling Technician
          - (c) Nuclear Technician
          - (d) Laboratory Technician
        - (3) Skilled Labor
          - (a) Welder
          - (b) Machinist

Suggested Student Activities	**References/AV/Supplies/Equipment**
Participate in one of four groups (1 A.D. to 1700 A.D., 1700 A.D. to 1900 A.D., 1900 A.D. to 1950 A.D., 1950 A.D. to Present) to research and present in a creative way (mural, role play, diorama, poster, drawing, poem, etc.) the transportation modes used for the following purposes during that time period: transport family in the community, transport people cross country, transport people across oceans, transport goods on a farm, transport goods cross country. Explain the presentation to the class and discuss the differences ob-served.	
Add to the technology timeline significant technological developments related to energy and power technology.	Listar, Technology Activity Guide I, pp. 73-77.
Make a collage showing the ways in which people use technology in energy and power with one another or research an early energy and power device, construct a model of it and make a class presentation about the device and the role it has played in the history of energy and power technology.	Bame, Exploring Technology, Activity Manual, pp. 25-27.
Participate in class discussion related to potential safety hazards of energy and power as well as transportation, equipment safety guards that have been developed, and personal protective equipment available to provide safer working conditions.	
Participate in a class discussion related to career opportunities in energy and power as well as transportation.	
Compile a list of occupations related to energy and power as well as transportation. Review the differences among professional, technical, skilled/semi-skilled, service, clerical and sales occupational classifications. Complete a worksheet by selecting the classification level of each occupation and describing the type of work in each occupation.	

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
- **A. Overview of Energy and Power**
  - **7. Careers**
    - **a. Selected Energy and Power Occupations**
      - (4) Semi-Skilled Labor
        - (a) Heavy Truck Driver
        - (b) Derrick Operator
        - (c) Pipeline Worker
        - (d) Stripping Shovel Operator
        - (e) Generating Plant Operator
      - (5) Service/Clerical and Sales
        - (a) Heavy Equipment Mechanic
        - (b) Heating/Cooling Mechanic
        - (c) Service Station Attendant
        - (d) Salesperson
        - (e) Secretary
        - (f) Clerk
    - b. Selected Transportation Occupations
      - (1) Professional
        - (a) Manager
        - (b) Design Engineer
        - (c) Research Scientist
        - (d) Officers
        - (e) Navigator
        - (f) Pilot
      - (2) Technical
        - (a) Computer Programmer
        - (b) Instrumentation and Control Technician
        - (c) Air Traffic Controller
      - (3) Skilled/Semi-Skilled Labor
        - (a) Locomotive Engineer
        - (b) Bus Driver
        - (c) Taxicab Driver
      - (4) Service/Clerical and Sales
        - (a) Ticket Agent
        - (b) Flight Attendant
        - (c) Cargo Handler
        - (d) Auto/Diesel Mechanic
        - (e) Marine Equipment Mechanic
        - (f) Airframe Mechanic
        - (g) Secretary
        - (h) Clerk
        - (i) Salesperson

Suggested Student Activities	References/AV/Supplies/Equipment
Select at least two occupations and research information about the skill and the educational requirements, the long-range potential for employment in that occupation, and working conditions. Participate in a class discussion related to energy and power occupations as well as transportation occupations.	
Write brief energy facts to be included in the school announcements throughout the year.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

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Lesson Title: Nature and Conversion of Energy

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this lesson each student will learn fundamental concepts and skills related to sources, basic principles, forms, states, conversion methods, and resource conservation of energy.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: force, work, energy, power, friction, efficiency fuel, synthetic fuels, geothermal, ocean thermal, fission, fusion, biofuels.
2. Begin using the designated vocabulary terms along with the proper names of equipment materials and processes in classroom and informal conversations.
3. Identify the earth's greatest source of energy. *ITE 4.1, 4.3*
4. From a list of energy sources classify each as natural energy sources, fossil fuels, biofuels, nuclear fuels, or synthetic fuels. *ITE 4.1, 4.3*
5. Distinguish among fossil, bio and synthetic fuels.
6. State the two basic principles related to energy. *ITE 4.1, 4.3*
7. List and distinguish among the usable forms of energy. *ITE 4.1, 4.3*
8. Distinguish between potential and kinetic energy. *ITE 4.1, 4.3*
9. From a list of examples of energy, classify each as kinetic or potential energy. *ITE 4.3*
10. Distinguish between direct and indirect energy conversion methods. *ITE 4.3*
11. Construct a working model of devices that convert energy and control energy conversion. *ITE 4.11, 4.12, 4.13, 4.14*
12. Perform in a safe manner the processes necessary for demonstrating the use of energy and for constructing devices applying the use of energy. *ITE 2.18, 4.7, 4.11, 4.12*
13. From a given list of conversion devices match each with the conversion method it uses. *ITE 4.1, 4.3, 4.4*
14. List or select from a list three renewable, three inexhaustible, and three exhaustible sources of energy and cite an example of how each renewable source may be renewed. *ITE 4.1*
15. Explain why conserving energy is important to our society and the world as a whole. *ITE 2.8, 2.13*
16. List at least ten energy sources presently used in the United States. *ITE 4.1, 4.2*

Content Outline	Teacher Plans and Activities

- III. Energy And Power Technology
  - B. Nature of Energy
    - 1. Sources of Energy
      - a. Natural Energy Sources
        - (1) Wind
        - (2) Water
        - (3) Solar Thermal
        - (4) Ocean Thermal
        - (5) Geothermal
        - (6) Human Muscle
        - (7) Animal Muscle
      - b. Energy Sources Requiring Refinement
        - (1) Fossil Fuels
          - (a) Coal
          - (b) Oil
          - (c) Natural Gas
        - (2) Biofuels (Biomass)
          - (a) Plants
          - (b) Wood
          - (c) Animals
          - (d) Animal Waste
          - (e) Plant Waste
          - (f) Sewage/Garbage
        - (3) Nuclear Fuels
          - (a) Uranium
          - (b) Plutonium
        - (4) Synthetic Fuels
          - (a) Synfuels (Marlstone)
          - (b) Synthesis Gas (Biomass)
    - 2. Basic Principles of Energy
      - a. Energy Can Not Be Destroyed or Created
      - b. Through Use, the Ability of Energy To Do Work Is Downgraded Even Though the Energy Is Not Destroyed
    - 3. Forms of Energy
      - a. Theoretical Solar Energy Spectrum
        - (1) Atomic
        - (2) Chemical (Molecular)
        - (3) Mechanical
        - (4) Electromagnetic
        - (5) Radiant
        - (6) Cosmic

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Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to definition of terms in competency #1, as well as sources of energy and basic principles of energy.	"The World of Energy", wall chart and study materials by Exxon Corporation, NY, NY Available from EPCOT Educational Media , 500 S. Buena Vista St., Burbank, CA 91521
View the film or video tape "Energy: The Fuels and Man".	National Geographic Educational Service, c/o Karol Media, 22 Riverview Dr., Wayne, NJ. 07470 (23 minutes, free preview, $35 rent).
Observe a classroom demonstration showing the operations necessary to construct a working model of a water wheel, a windmill, a windpowered car, or a model coal slurry system.	
In groups of two construct a working model of a water wheel, a windmill, or a windpowered car and demonstrate it's operation to the class.	Illinois, Introducing the Exploration Series, pp. 78-106; Bame, Exploring Technology, Activity Manual, pp. 33-35; Harms, Energy, Power, and Transportation, Technology Activities, pp. 25-29; Todd, Understanding and Using Technology, Guide for Teachers, pp. 9-14, 36-37; Smith, Instructor's Guide For Exploring Energy, pp. 32-33; Utah, Industrial Arts-Agriculture, "Windpower"; Heiner, People Create Technology, Activitiy Manual, pp. 63-64, 89-90.
Construct a model coal slurry system to show how hard to reach coal is extracted.	Utah: Energy-Power-Transportation Course Guide, pp. 66.
Participate in a TEACHER-LED group experiment in which a small piece of coal is burned in a safe place outside of the building and observe the heat energy being released, the ash left, and the smoke and odor; or participate in the "Characteristics of Burning Wood Activity" using different kinds of wood and recording data on a worksheet. BE SURE THAT PROPER SAFETY PRACTICES ARE FOLLOWED IN THESE ACTIVITIES. Discuss the advantages and disadvantages related to burning coal or burning wood as heat sources.	Indiana, Industrial Technology Education Curriculum, Energy Systems, pp. 34; Stephenson, Power Technology, Student Manual, Delmar, pp. 67.
List and discuss the ways that petroleum energy was used by class members during a specified day.	

Content Outline

- **III. Energy and Power Technology**
  - **B. Nature of Energy**
    - **3. Forms of Energy**
      - b. Usable Forms of Energy
        - (1) Nuclear
          - (a) Fission
          - (b) Fusion
        - (2) Thermal (Heat)
          - (a) Direct
          - (b) Converted
        - (3) Chemical
          - (a) Oxidation
          - (b) Reaction
        - (4) Motion (Mechanical)
          - (a) Simple Machines
          - (b) Complex Machines
        - (5) Electrical
          - (a) Static
          - (b) Current
        - (6) Light
          - (a) Direct
          - (b) Converted
    - 4. States of Energy
      - a. Kinetic (In Use)
      - b. Potential (Stored For Use)
        - (1) Chemical Fuel Energy
          - (a) Biofuels
          - (b) Fossil Fuels
        - (2) Nuclear Fuel Energy
        - (3) Motion Energy
          - (a) Inertia (Flywheel)
          - (b) Gravity (Pumped Storage)
          - (c) Deformation (Spring)
        - (4) Electrical Energy
          - (a) Chemical (Battery)
          - (b) Electrons (Capacitor)
          - (c) Magnetism (Magnet)
        - (5) Pressurized Fluid Energy
        - (6) Thermal Mass Energy
  - C. Conversion of Selected Energy Forms
    - 1. Direct Conversion Methods/Devices
      - a. Chemical to Electrical
        - (1) Batteries
        - (2) Fuel Cells
      - b. Thermal to Electrical
        - (1) Magneto-Hydrodynamic
        - (2) Thermoelectric Generator
        - (3) Thermoelectric Convertor

Teacher Plans and Activities

Examples of possible devices and products to illustrate forms of energy (being concerned only about the output of the device or product and not the conversion of energy represented):

hitting a nail with a hammer
(motion)
an automobile--use a model
(motion, elect., chem., light, thermal)
electric heater
(thermal)
melting ice cubes
(thermal)
solar cell
(electrical)
incandescent lamp
(light)
piece of coal
(chemical)
an apple
(chemical)
electric motor
(motion)
radio
(motion--sound)
a piece of synthetic uranium--round piece of dark plastic rod
(nuclear)
a speaker
(motion--sound)
a model of a hydrogen atom
(nuclear)
(Indiana, Industrial Technology Education Curriculum, Energy Systems, 1987, pp. 46)

Suggested Student Activities	References/AV/Supplies/Equipment
Plot on a map the large transmission pipelines that bring natural gas to your community.	Stephenson, Power Technology, Student Manual, pp. 68; "Gilmore's Guide To Natural Gas" Booklet and Teacher's Guide, "What Is A Gas?", American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209.
View the film or video tape "The Refinery Film".	Modern Talking Picture Service, 5000 Park St. North, St. Petersburg, FL 33709 (22 minutes, free loan).
Participate in a class discussion related to the use of biofuel (food) as energy for human and animal muscle power as well as ways that your community could expand it's use of biomass as an energy source.	
View a film or a video tape related to the use of waste and garbage as biofuel and discuss the related issues.	
Observe a class demonstration to simulate a nuclear reaction by placing a dozen or more mouse traps in a cardboard box with a ping pong ball on each bait holder. Place glass over the top. Trigger one mouse trap and compare the action to that of a nuclear reaction.	Stephenson, Power Technology, Student Manual, pp. 65.
View the film or video tape "Nuclear Power".	Hawkins Associates, P.O. Box 1028, Madison, WI 53701 (33 minutes, $56 rent, $118 purchase).
Research the development of a specified energy source and make an 8.5" x 11" poster describing the source and its uses. These posters may be compiled for a given class, duplicated, published as a booklet and distributed to the class members. (See Unit I, Lesson 3)	Stephenson, Power Technology, Student Manual, pp. 65; Listar, Technology Activity Guide 1, pp. 95-99.
Participate in a class discussion related to forms of energy, states of energy and conversion of selected energy forms.	"Electric Generation" Poster, National Energy Foundation, 5160 Wiley Post Way, Suite 200, Salt Lake City, Utah 84116.
Observe a class demonstration on forms of energy.	
Participate in a field trip to an electrical generating plant, such as a metropolitan generating plant, a hydroelectric dam, or a nuclear generating plant. Observe the basic principles of operation, the steps taken for safety, and the effect on the environment.	Stephenson, Power Technology, Student Manual, pp. 64.

Content Outline	Teacher Plans and Activities

III. Energy And Power Technology
- **C. Conversion of Selected Energy Forms**
  - **1. Direct Conversion Methods/Devices**
    - c. Motion to Electrical
      - (1) Generator
    - d. Optical to Electrical
      - (1) Photovoltaic Cell
    - e. Electrical to Motion
      - (1) Motor
    - f. Fluid to Motion
      - (1) Windmill
      - (2) Turbine
    - g. Motion to Fluid
      - (1) Pump
      - (2) Fan
    - h. Electrical to Thermal
      - (1) Heater
    - i. Electrical to Optical
      - (1) Light Bulb
  - 2. Indirect Conversion Methods/Devices
    - a. Chemical to Heat to Motion
      - (1) Internal Combustion Engine
      - (2) External Combustion Engine
    - b. Chemical to Heat to Motion to Electrical
      - (1) Boiler
      - (2) Furnace
    - c. Nuclear to Heat to Fluid to Motion to Electrical
      - (1) Nuclear Power Plant
- D. Conservation of Energy Resources
  - 1. Renewable
    - a. Wood
    - b. Plants
    - c. Waste By-Products
    - d. Animal Power
    - e. Human Power
    - f. Synthetic
  - 2. Inexhaustible
    - a. Solar
    - b. Tidal
    - c. Wave
    - d. Wind
    - e. Geothermal
    - f. Ocean Thermal
    - g. Gravitational
    - h. Atomic Fusion
  - 3. Exhaustible
    - a. Coal
    - b. Oil
    - c. Natural Gas
    - d. Uranium
    - e. Synthetic
- E. Choice of Optimum Energy Source

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Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion led by a representative of a power company related to the generation and distribution of electrical energy or by a member of the community describing a solar collector and/or a wood stove as energy sources.	
Observe a class demonstration showing the operations necessary to construct an energy conversion device, such as a thermocouple, a voltaic cell, a solar collector, a magneto or a generator.	
Design and construct an energy conversion device, such as a thermocouple, a voltaic cell, a solar collector, a magneto or a generator.	New York: Intro To Technology, Grade 7, pp. 20; Todd, Activity Manual, pp. 47-56; Bame, Activity Manual, pp. 29-44; Heiner, Activity Manual, pp. 87-92; Utah, Industrial Arts-Agriculture, "Photovoltaics"; Harms, Energy, Power, and Transportation Technology Activities, pp. 30-36.
Examine and participate in a class discussion related to the household pressure cooker and how it uses steam under pressure.	Stephenson, Power Technology, Student Manual, pp. 52.
Observe a class demonstration showing the operations necessary to construct a model "Hero's Steam Engine".	
In a small group construct a model "Hero's Steam Engine" and participate in a class discussion related to the concepts of inertia and friction as applied to this model.	Hacker, Living With Technology, pp. 432-433.
Observe a class demonstration showing the operations necessary to construct a motion device using a spring or a rubber band for an energy source.	
Construct a toy or motion device using a spring or rubber band for an energy source, such as a balsa wood racer powered by a mousetrap, a spool tractor powered by a rubber band, or a penny-toss device powered by a rubber band. Discuss with at least two other members of the class the use of kinetic energy and potential energy in the device selected.	Smith, Instructor's Guide For Exploring Energy, pp. 4; Hacker, Living With Technology, pp. 408-409.
Participate in a class discussion related to conservation of energy resources and choice of optimum energy source.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 68-69, 71-93.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 113-131.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 501-509, 569-579.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 388-403, 416-423.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 35-43.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 360-367.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 400-407.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 81-105.
Williams, et al., Technology At Work, South-Western, 1987, pp. 34-37, 109-139.

Selected Readings On Energy and Power

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 12-31, 35-44, 65-68.
Center For Occupational Research and Development and Agency For Instructional Technology, Principles of Technology, Teacher's Guide, Center For Occupational Research and Development, 1984.
Debates: Nuclear Energy, Macdonald and Company Ltd., 3rd Floor, Greater London House, Hampstead Rd., London, NW1 7QX, 1987.
Fuels and Energy, Macdonald and Company Ltd., 3rd Floor, Greater London House, Hampstead Rd., London, NW1 7QX, 1987.
Laithwaite, Eric, Force: The Power Behind Movement, Franklin Watts, 387 Park Avenue South, NY, NY 10016, 1986.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-1-E to ETE-89-E.
Schwaller, Energy Technology: Sources of Power, Davis, 1980, pp. 9-21, 61-411.
Smith, Exploring Energy: Sources/Applications/Alternatives, Goodheart-Willcox, 1985, pp. 10-33, 51-108, 115-274.

Lesson Title: Systems of Power Transmission

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to the basic components of power transmission systems as well as the conservation of energy in its use.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: work, power, force, torque, pressure, horsepower, efficiency, velocity, acceleration, friction.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Sketch and describe the components of a basic power system. *ITE 4.4*
4. Differentiate among manual, semi-automatic, automatic, and cybernetic control systems. *ITE 4.5*
5. List examples of manual, semi-automatic and automatic measuring devices. *ITE 4.5*
6. Perform an energy audit of a specified home. *ITE 2.19, 4.7*
7. Identify the most common energy source, conversion method, transmission path, control system, measurement devices, and output of a given power system. *ITE 4.1, 4.3, 4.4, 4.5, 4.7, 4.8, 4.20, 4.23, 4.32*
8. Identify ways that energy can be conserved in the residential, industrial, and transportation sections of society.
9. Discuss the impact of selected power transmission systems on our society. *ITE 2.8*
10. Follow in all laboratory activities the safety regulations applying in the laboratory. *ITE 2.18*

Content Outline	Teacher Plans and Activities

- III. Energy and Power Technology
  - F. Systems of Power Transmission
    - 1. Basic Components of Power Transmission Systems
      - a. Energy Source
      - b. Conversion Method
      - c. Transmission Path
      - d. Control System
        - (1) Types
          - (a) Manual
          - (b) Semi-Automatic
          - (c) Automatic
        - (2) Devices
          - (a) Switches
          - (b) Valves
      - e. Measurement Units and Devices
        - (1) Units
        - (2) Types
          - (a) Manual
          - (b) Semi-Automatic
          - (c) Automatic
          - (d) Cybernetic
        - (3) Devices
          - (a) Meters
          - (b) Gauges
      - f. Output/Load
        - (1) Mechanical Applications (Motion)
        - (2) Thermal Applications (Heat)
        - (3) Light Applications (Light)
      - g. Conservation of Energy Use
        - (1) By Improved Efficiency
          - (a) Reduce Friction
          - (b) Use of Optimal Size Power System
          - (c) Use of Natural Energy Sources
          - (d) Alternate Use of Excess Heat
          - (e) Other
        - (2) By Sector
          - (a) Residential Sector
          - (b) Industrial Sector
          - (c) Transportation Sector
      - h. Impact of Power Transmission System

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion.related to definition of terms in competency #1 as well as basic components of power transmission systems.	
List the components of a basic power transmission system and give examples of these components for at least five different power transmission systems used in and around the home.	
In groups of two or three, examine several simple toys to analyze the power transmission systems used and discuss the components of each system.	
Build and test a mousetrap car; identify and describe the basic components of this power transmission system.	Todd, Understanding and Using Technology, Activity Manual, pp. 47-49.
Examine and describe the functions/actions of common control devices. Classify each device as manual, semi-automatic, automatic or cybernetic (e.g. electrical switches, water faucet, oven temperature control, electric timer, water heater safety valve).	
Develop a list of at least five measurement devices used in power systems around the home and classify each device as a manual, semi-automatic, or automatic meter or gauge. Draw a sketch of each meter or gauge and indicate a typical measurement reading.	
Read a kilowatt hour meter and a gas meter.	Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 61-62.
Participate in a class discussion showing the relationship of force applied to the four power transmission systems, the conservation of energy in its use, and the impact of power transmission on society.	
Inspect a residence, school or industrial building to discover ways to conserve energy, then develop a plan for saving energy.	Bame, Exploring Technology, Activity Manual, pp. 70-73.
Perform a heat energy audit on your home.	Utah, Energy-Power-Transportation, Course Guide, pp. 58, Bame, Exploring Technology, Activity Manual, pp. 67-70; Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 65-67.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 93-100.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 132-135.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 413-429.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 360-363.
Williams, et al., Technology At Work, South-Western, 1987, pp. 38, 113.

Selected Readings On Energy and Power

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 78, 96-101, 125-126.
Center For Occupational Research and Development and Agency For Instructional Technology, Principles of Technology, Teacher's Guide, Center For Occupational Research and Development, 1984.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-39-E to ETE-144-E.
Smith, Exploring Energy: Sources/Applications/Alternatives, Goodheart-Willcox, 1985, pp. 35-50.

Revision Notes:

Lesson Title: Mechanical Power Transmission Systems

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this lesson each student will learn fundamental concepts and skills related to mechanical power transmission systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: gears, gear ratio, pulleys and belts, sprockets and chains, clutch, coupling, mechanical advantage, friction, bearings.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Match mechanical transmission/control devices with the correct descriptions. *ITE 4.4, 4.5*
4. List and describe the actions/functions of several transmission/control devices. *ITE 4.4, 4.5*
5. Identify three ways that a mechanical transmission/control system can control power. *ITE 4.4, 4.5*
6. Determine direction of rotation and power ratio for each element of a gear train, pulley/belt system and sprocket/chain system. *ITE 4.12, 4.20*
7. Calculate the mechanical advantage of a machine when given the distances or forces involved. *ITE 2.19, 4.12*
8. Categorize specified mechanical power control systems as manual, semi-automatic, or automatic. *ITE 4.4, 4.5*
9. Read meters/measuring devices within the designated accuracy range for selected mechanical power transmission systems. *ITE 4.7, 4.8*
10. Name six simple machines. *ITE 4.4*
11. Explain how simple machines can be used to control and transmit mechanical power. *ITE 4.4, 4.5*
12. List and describe typical applications of mechanical power transmission/control systems. *ITE 4.4, 4.5*
13. Identify three methods of reducing friction in a mechanical power transmission system.
14. Identify the basic parts of a two-cycle or four-cycle internal combustion engine. *ITE 4.4, 4.10*
15. Identify the most common: energy source, conversion method, transmission path, control system, measurement device, and output of a given mechanical power system. *ITE 4.1, 4.3, 4.4, 4.5, 4.7, 4.8, 4.20, 4.23, 4.32*
16. Follow in all laboratory activities the applicable safety regulations. *ITE 2.18*

Content Outline **Teacher Plans and Activities**

- **III. Energy and Power Technology**
  - **F. Systems of Power Transmission**
    - 2. Mechanical Power Transmission Systems
      - a. Typical Energy Sources (Input)
        - (1) Human (Bicycle)
        - (2) Heat Engine (Automobile)
        - (3) Wind (Windmill)
      - b. Typical Conversion Methods
        - (1) Chemical to Reciprocating Motion to Rotary Motion (Human On Bicycle)
        - (2) Chemical to Thermal to Reciprocating Motion to Rotary Motion (Automobile)
        - (3) Linear Motion to Rotary Motion (Windmill)
      - c. Transmission and/or Control Techniques
        - (1) On/Off Switching
        - (2) Changing Direction
          - (a) Reversing
          - (b) Turning
          - (c) Changing One Type Of Motion For Another
        - (3) Changing Force/Speed
      - d. Transmission and/or Control Devices
        - (1) Gears
        - (2) Pulleys and Belts
        - (3) Sprockets and Chains
        - (4) Clutches
        - (5) Shafts and Couplings
        - (6) Cams
        - (7) Levers
        - (8) Governors
        - (9) Cables
      - e. Measurement
        - (1) Customary Units (Metric)
          - (a) Foot-Pound (Joule)
          - (b) Pound-Foot (Newton-Meter)
          - (c) Horsepower (Watt)
        - (2) Devices
          - (a) Torque Wrench
          - (b) Dynamometer

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Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to definition of gears, gear ratio, pulleys and belts, sprockets and chains, clutch, coupling, mechanical advantage, friction, and bearings.	
Participate in a class discussion related to energy sources, conversion methods, and transmission and/or control techniques and devices of mechanical power transmission systems.	
Explore the mechanical transmission/control of power by assembling the "Capsela 1000" Kit.	Utah, Industrial Arts-Agriculture, "Mechanical Power:.
Set up various pulley systems to show the mechanical advantage of force that can be gained from pulleys. Compare the distance the weight moves to the length of rope pulled through the pulleys, to determine the mechanical advantage of force. Use a spring scale to check the mechanical advantage of the pulley system.	Stephenson, Power Technology, Student Manual, pp. 56; Kansas, Power and Energy Curriculum Guide, pp. 112-114.
Determine rotation direction and power ratios for specified gear trains, pulley/belt systems, and sprocket/chain systems.	MAVCC, Exploring Energy, Power, and Transportation Technology, Student Manual, pp. EEPT-211; Kansas, Power and Energy Curriculum Guide, pp. 120-123.
A bicycle is an excellent example of a power transmission system. Examine a five speed bicycle. Be sure to include the following: How many teeth are on the front sprocket? How many teeth are on the gears of the rear sprocket? What are the mechanical advantages of force for the various speeds of the bicycle? How far will the bicycle travel in one revolution of the pedals, each speed? What class of lever do the caliper brakes represent?	Stephenson, Power Technology, Student Manual, pp. 58; Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 85-87.
Demonstrate the action of a universal joint using a universal joint from a socket wrench set.	Stephenson, Power Technology, Student Manual, pp. 56.

Content Outline	Teacher Plans and Activities

- **III. Energy and Power Technology**
  - **F. Systems of Power Transmission**
    - **2. Mechanical Power Transmission Systems**
      - f. Scientific Principles
        - (1) Mechanical Advantage
        - (2) Simple Machines
        - (3) Friction
      - g. Typical Applications (Output)
        - (1) Transportation
          - (a) Bicycle
          - (b) Automobile
          - (c) Train
        - (2) Communication
          - (a) String &Percussion Instruments
          - (b) Camera
          - (c) Simple Printing Presses
        - (3) Manufacturing
          - (a) Machinery
          - (b) Material Handling Systems
          - (c) Heavy Equipment
        - (4) Construction
          - (a) Hand Tools
          - (b) Material Handling Systems
          - (c) Heavy Equipment
      - h. Conservation of Energy Use
        - (1) Friction Reduction
          - (a) Sleeve Bearings
          - (b) Anti-Friction Bearings
          - (c) Lubricant
        - (2) Optimal Size Power System
        - (3) Alternate Use of Excess Heat
        - (4) Other
      - i. Impact of Mechanical Power Transmission Systems

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion on units and devices for measurement, scientific principles, and typical applications.	
Bring examples of levers to class. Explain what class of lever and what the mechanical advantage of force is for each one.	Stephenson, Power Technology, Student Manual, pp. 56.
Perform experiments concerning friction, levers, wheels and axles, inclined planes, and pulleys.	Kansas, Power and Energy Curriculum Guide, pp. 61-68; Teacher's Laboratory Catalog, p. 18.
Demonstrate several ways that simple machines are used to provide a mechanical advantage.	Bame, Exploring Technology, Activity Manual, pp. 57-60; Teacher's Laboratory Catalog, p. 18; MAVCC, Exploring Technology Education, pp. ETE-125-E to ETE-127-E.
Bring in mechanical toys and discarded mechanical devices. Dissemble and/or analyze the working parts for illustrations of simple machines and calculate the mechanical advantages applying.	Stephenson, Power Technology, Student Manual, p. 56.
Observe a demonstration of the operation and typical adjustments/maintenance required of a two-cycle and/or four-cycle gasoline engine.	A demonstration engine may be provided by Briggs and Stratton; Bame, Exploring Technology, Activity Manual, pp. 49-51..
Safely inspect a power lawn mower in preparation for use and perform required daily maintenance. Explain the proper clothing to wear when using a power lawn mower.	Stephenson, Power Technology, Student Manual, p. 5; Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 131-139.
Mechanical engineering contest. Give the students a bag of preselected materials and as homework have them invent a catapult to propel a selected load a predetermined distance. For example, design a catapult to throw a ping pong ball the farthest or to toss a penny into a target.	Utah: Energy-Power-Transportation Course Guide, p. 60; Hacker, Living With Technology, pp. 408-409.
Participate in a class discussion related to conservation of energy use, and impacts of mechanical power transmission systems.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 96-98.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 27-42.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 580-586.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 33-36, 424.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 31-34, 343-344.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 14-31.
Williams, et al., Technology At Work, South-Western, 1987, pp. 25-32.

Selected Readings On Energy and Power

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 70-87.
Center For Occupational Research and Development and Agency For Instructional Technology, Principles of Technology, Teacher's Guide, Center For Occupational Research and Development, 1984.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-91-E to ETE-144-E.
Schwaller, Energy Technology: Sources of Power, Davis, 1980, pp. 54-58.

Revision Notes:

Lesson Title: Electrical Power Transmission Systems

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to electrical power transmission systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: volt, ampere, ohm, watt, circuit, conductor, semi-conductor, insulator, current, transformer, electromagnetic, capacitor, inductor, magnetism.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Match electrical transmission/control devices with the correct descriptions. *ITE 4.4, 4.5, 4.6*
4. List and describe the function/action of several electrical transmission/control devices. *ITE 4.4, 4.5, 4.6*
5. Identify six ways that an electrical transmission/control system can control power. *ITE 4.4, 4.5, 4.6*
6. Categorize specific electrical power control systems as manual, semi-automatic, or automatic. *ITE 4.4, 4.5, 4.6*
7. Read sample meters/measuring devices within the designated accuracy range for selected electrical power transmission systems.. *ITE 4.7, 4.8*
8. Draw Ohm's law in triangular expression. *ITE 4.3*
9. Solve problems using Ohm's Law. *ITE 2.19, 4.12*
10. Distinguish between direct current and alternating current electricity. *ITE 4.3*
11. Distinguish between a series and a parallel circuit.
12. Distinguish between a cell and a battery. *ITE 4.3*
13. List and describe typical applications of electrical power transmission/control systems. *ITE 4.4, 4.5, 4.6*
14. Describe differenc[illegible] between an incandescent and a fluorescent light source. *ITE 4.20*
15. Identify the most common: energy source, conversion method, transmission path, control system, measurement device, and output of a given electrical power system. *ITE 4.1, 4.3, 4.4, 4.5, 4.7, 4.8, 4.20, 4.23, 4..32*
16. Follow in all laboratory activities the applicable safety regulations. *ITE 2.18*

Content Outline | **Teacher Plans and Activities**

III. Energy and Power Technology

F. Systems of Power Transmission

3. Electrical Power Transmission Systems
    a. Typical Energy Sources (Input)
        (1) Battery (Flashlight)
        (2) Heat Engine (Automobile Alternator)
        (3) Falling Water (Hydro-electric Power Plant)
    b. Typical Conversion Methods
        (1) Chemical to Electrical to Light (Flashlight)
        (2) Chemical to Thermal to Rotary Motion to Electrical (Alternator)
        (3) Linear Motion to Electrical (Hydro-electric Power Plant)
    c. Transmission and/or Control Techniques
        (1) On/Off Switching
        (2) Changing Direction/Polarity
        (3) Changing Current
            (a) Rectifying Current
            (b) Changing Voltage
        (4) Filtering Current/Capacitance
        (5) Controlling Overload
        (6) Controlling Motion
        (7) Controlling Heat/Light

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Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to definition of volt, ampere, ohm, watt, circuit, conductor, semi-conductor, insulator, current, transformer, electromagnetic, capacitor, inductor, and magnetism.	
Participate in a class discussion related to energy sources, conversion methods and transmission and/or control techniques and devices of electrical power transmission systems.	
Cut apart dry cells and batteries to show their cross-sectional construction.	
Observe a demonstration on electrical transmission and control techniques and devices.	
Prepare a chart of electrical conductors, semi-conductors, and insulators.	
Assemble simple electronic experiments using the solderless circuit board and other components.	Utah, Industrial Arts-Agriculture Curriculum Guide, pp. "Electronics".
Arrange electrical components to control the transmission of electrical energy.	Bame, Exploring Technology, Activity Manual, pp. 63-66.
Participate in a class discussion related to units and devices of measurement as well as scientific principles.	
Observe a demonstration related to solving problems using Ohm's Law, related to series and parallel circuits and related to the use of test equipment.	
Use dry cells, flashlight bulbs, and receptacles to set up basic series and parallel circuits. Complete a worksheet using testing equipment to verify electrical power, current, resistance, and force involved in the circuits.	Stephenson, Power Technology, Student Manual, pp. 53; Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 77-78.
View a film strip presentation "Discovering Magnets and Electricity".	Society for Visual Education, 1345 Diversey Parkway, Chicago, IL 60614, ($35).

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
- **F. Systems of Power Transmission**
  - **3. Electrical Power Transmission Systems**
    - d. Transmission and/or Control Devices
      - (1) Conductors
      - (2) Insulators
      - (3) Semi-Conductors
      - (4) Switches
      - (5) Relays
      - (6) Transistors
      - (7) Diodes
      - (8) Transformers
      - (9) Resistors
      - (10)Variable Resistors
      - (11)Fuses
      - (12)Circuit Breakers
      - (13)Solenoids
      - (14)Motors
      - (15)Resistance Coils
      - (16)Filaments
    - e. Measurement
      - (1) Units
        - (a) Ohm (Resistance)
        - (b) Volt (EMF)
        - (c) Amperage (Current)
        - (d) Watt (Electrical Power)
        - (e) Hertz (Frequency)
      - (2) Devices
        - (a) Ohmmeter
        - (b) Voltmeter
        - (c) Ammeter
        - (d) Wattmeter
        - (e) Frequency Meter
        - (f) Oscilloscope
    - f. Scientific Principles
      - (1) Current
        - (a) Alternating Current
        - (b) Direct Current
      - (2) Resistance
      - (3) Voltage
      - (4) Ohm's Law
      - (5) Series Circuits
      - (6) Parallel Circuits
      - (7) Magnetism
      - (8) Electromagnetic Induction
      - (9) Frequency
      - (1 0 Rectification
      - (11) Capacitance

Suggested Student Activities	References/AV/Supplies/Equipment
Show how a moving magnetic field can cause current flow. Use a compass, permanent magnet, and wire.	Stephenson, Power Technology, Student Manual, pp. 54.
Solve problems using Ohm's Law.	MAVCC, Energy, Power, and Transportation Technology, Student Manual, pp. EEPT-83—EEPT-84.
Build an electroscope to demonstrate electron flow.	Stephenson, Power Technology, Student Manual, pp. 53.
Build a lemon clock.	School Shop, September,1983.
Use solar cells or human muscle power to produce electricity.	Heiner, People Create Technology, Activity Manual, pp. 91; Hacker, Living With Technology, pp. 410-411.
Compare the efficiency of incandescent and fluorescent light sources.	Smith, Instructor's Guide For Exploring Energy, pp. 33-34.
Observe a demonstration related to building a bimetallic thermostat, an electrical motor and an electrical generator.	Indiana, Industrial Technology Education Curriculum, Energy Systems, pp. 75-76.
Build a bimetallic thermostat.	
Build an electric motor.	Bame, Exploring Technology, Activity Manual, pp. 41-42; Groneman, General Industrial Education and Technology, pp. 553-554; MAVCC, Exploring Technology Education, pp. ETE-67-E to ETE-73-E.
Build an electric generator.	Bame, Exploring Technology, Activity Manual, pp. 37-40; Teacher's Laboratory Catalog, p. 15.
Build a light-activated vehicle.	Kaufman, Allan. "Building A Light-Activated Vehicle Teaches Electronic Fabrication", School Shop, January 1988, pp. 33-35.

Content Outline	**Teacher Plans and Activities**

III. Energy and Power Technology
- **F. Systems of Power Transmission**
  - **3. Electrical Power Transmission Systems**
    - g. Typical Applications (Output)
      - (1) Transportation
        - (a) Electric Trains
        - (b) Electric Cars
        - (c) Conveyance Systems
      - (2) Communication
        - (a) Radio/Television
        - (b) Telephone
        - (c) Satellite
      - (3) Manufacturing
        - (a) Robotics
        - (b) Laser
        - (c) Electroplating
      - (4) Construction
        - (a) Power Tools
        - (b) Material Handling
        - (c) Welding
    - h. Conservation of Energy Use
    - i. Impact of Electrical Power Transmission Systems

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to applications of electrical power transmission systems, conservation of energy use, and impact of electrical power transmission systems.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 76-78, 93-96.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 132-133.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 518-554.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 91-95, 336-338, 423, 425-426.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 135-139, 342-343.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 327-346.
Williams, et al., Technology At Work, South-Western, 1987, pp. 146-169.

Selected Readings On Energy and Power

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 116-145.
Center For Occupational Research and Development and Agency For Instructional Technology, Principles of Technology, Teacher's Guide, Center For Occupational Research and Development, 1984.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-91-E to ETE-144-E.
Schwaller, Energy Technology: Sources of Power, Davis, 1980, pp. 314-322.

Revision Notes:

Lesson Title: Fluid Power Transmission Systems

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to fluid power transmission systems--including both hydraulic and pneumatic systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: fluid, pressure, atmospheric pressure, vacuum, compressor, filter, transmission line, actuator, hydraulics, pneumatics, air tank, accumulator.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Categorize fluid transmission/control systems as either hydraulic or pneumatic. *ITE 4.1, 4.4*
4. Distinguish between those fluid transmission/control systems which transfer force and those which multiply force. *ITE 4.11, 4.12*
5. Match parts of fluid transmission/control devices with the correct description. *ITE 4.4, 4.5*
6. Categorize specific fluid power transmission/control systems as manual, semi-automatic, or automatic. *ITE 4.4, 4.5*
7. Read sample meters/measuring devices within the designated accuracy range for selected fluid power transmission systems. *ITE 4.7, 4.8*
8. Distinguish among a compound gauge, a regular gauge, and an absolute gauge. *ITE 4.5*
9. Identify sample pressure gauge readings as either above or below atmospheric pressure. *ITE 4.11, 4.12*
10. Identify the basic properties of Boyle's Law. *ITE 4.1*
11. Identify the basic properties of Charles' Law. *ITE 4.1*
12. Construct a fluid powered robotic arm. *ITE 4.11, 4.12, 4.13, 4.17, 4.20*
13. List and describe typical applications of fluid power transmission/control systems. *ITE 4.4, 4.5*
14. Identify the most common: energy source, conversion method, transmission path, control system, measurement device, and output of a given fluid power system. *ITE 4.1, 4.3, 4.4, 4.5, 4.7, 4.8, 4.20, 4.23, 4.32*
15. Follow in all laboratory activities the applicable safety regulations. *ITE 2.18*

Content Outline	**Teacher Plans and Activities**

III. Energy and Power Technology
  F. Systems of Power Transmission
    4. Fluid Power Transmission Systems
      a. Typical Energy Sources
        (1) Human (Hydraulic Jack)
        (2) Electric Pump (Hydraulic Automobile Hoist)
        (3) Heat Engine (Air Compressor)
      b. Typical Conversion Methods
        (1) Chemical to Reciprocating Motion to Multiplied Linear Motion (Hydraulic Jack)
        (2) Electrical to Rotary Motion to Multiplied Linear Motion (Hydraulic Automobile Hoist)
        (3) Chemical to Thermal to Rotary Motion to Multiplied Linear Motion (Air Compressor)
      c. Transmission and/or Control Techniques
        (1) Transferring Force
        (2) Multiplying Force
      d. Transmission and/or Control Devices
        (1) Fluids
        (2) Reservoirs/Receivers
        (3) Pumps/Compressors
        (4) Filters
        (5) Transmission Lines
        (6) Control Valves
        (7) Actuators
      e. Measurement
        (1) Customary Units (Metric)
          (a) Cubic Inch (Cubic Centimeter)
          (b) Pound Per Square Inch (Pascals)
          (c) Pounds (Newtons)
          (d) Pound-Feet (Newton-Meters)
          (e) Ounces (Milliliters
        (2) Devices
          (a) Compound Gauge
          (b) Regular Gauge
          (c) Absolute Gauge

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of fluid, pressure, atmospheric pressure, vacuum, compressor, filter, transmission line, actuator, hydraulics, pneumatics, air tank, and accumulator.	
Participate in a class discussion related to energy sources, conversion methods, transmission and/or control techniques and devices, and measurement units and devices of fluid power transmission systems.	
Observe a demonstration of the principles of hydraulics as shown on a hydraulic model.	Utah, Industrial Arts-Agriculture Curriculum Guide, "Hydraulics"; Bame, Exploring Technology, Activity Guide, pp. 61-62.
View video tapes "The Basics of the Fluid Power Industry" (13 minutes) and "Basics of Pneumatics" (14 minutes).	National Power Fluid Association, 2333 North Mayfair Road, Milwaukee, WI. ($120)
Observe a demonstration of the water pressure exerted in a large container that has three holes drilled in the side; one near the bottom, one in the middle, and one near the top. Fill the container and note the difference in water pressure.	Stephenson, Power Technology, Student Manual, pp. 58.
In groups of two or three examine parts of a hydraulic brake system including the master cylinder, brake line, individual brake cylinder, etc., and discuss the operation of this fluid power transmission system.	Stephenson, Power Technology, Student Manual, pp. 59.
Participate in a field trip to a service station to inspect the operation of the automobile lift and/or to a construction site to view fluid devices on heavy construction equipment.	Stephenson, Power Technology, Student Manual, 59.
Examine pneumatic hand tools and discuss their operation. What are the major advantages/disadvantages of these tools over electrically powered ones?	

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
- **F. Systems of Power Transmission**
  - **4. Fluid Power Transmission Systems**
    - f. Scientific Principles
      - (1) Fluid Pressure
      - (2) Vacuum
      - (3) Boyle's Law
      - (4) Charles' Law
      - (5) Hydraulics
      - (6) Pneumatics
    - g. Typical Applications
      - (1) Transportation
        - (a) Pneumatic Tubes
        - (b) Pipelines
        - (c) Brake Systems
      - (2) Communication
        - (a) Pneumatic Tubes
        - (b) "Air" Musical Instruments
        - (c) Speech
      - (3) Manufacturing
        - (a) Heavy Machinery
        - (b) Tools
        - (c) Equipment
      - (4) Construction
        - (a) Heavy Machinery
        - (b) Tools
        - (c) Equipment
    - h. Conservation of Energy Use
    - i. Impact of Fluid Power Transmission Systems

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Suggested Student Activities	References/AV/Supplies/Equipment
Assemble the pneumatic apparatus to operate a fish tank aerator with a vibrator diaphragm pump, tubes, and control valves.	Stephenson, Power Technology, Student Manual, 59.
Examine a late model automobile to see if it uses a pneumatic bumper system. Discuss it's operation.	
Complete a worksheet identifying the different fluid power transmission systems of an automobile.	Bohn, Energy, Power and Transportation Technology, p. 115.
Observe a demonstration of the operations necessary to construct a fluid powered robotic arm.	MAVCC, Exploring Energy, Power, and Transportation, Student Manual, pp. EEPT-213; Harms, Manufacturing Technology Activities, pp. 38-40.
Construct a fluid powered robotic arm using syringes, tubes, and liquid.	
Construct an open-end manometer and use it to measure pressure.	Kansas, Power and Energy, Curriculum Guide, pp. 193-195.
Locate examples of check valves and discuss their use.	Stephenson, Power Technology, Student Manual, 60.
Participate in a class discussion related to scientific principles, typical applications, conservation of energy use, and impacts of fluid power transmission systems.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 98-100.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 133.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 363.

Selected Readings On Energy and Power

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 89-115.
Center For Occupational Research and Development and Agency For Instructional Technology, Principles of Technology, Teacher's Guide, Center For Occupational Research and Development, 1984.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-91-E to ETE-107-E.

Revision Notes:

Lesson Title: Thermal Power Transmission Systems

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to thermal power transmission systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: heat, BTU, super-heated, geothermal, ocean thermal, conduction, radiation, convection, greenhouse effect.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Match thermal power transmission/control devices with the correct descriptions. *ITE 4.4, 4.5*
4. Identify examples of active air systems and active water systems. *ITE 4.4, 4.5*
5. Distinguish between active and passive thermal transmission/control systems. *ITE 4.1, 4.4, 4.5*
6. List common examples of the greenhouse effect. *ITE 4.1*
7. Categorize thermal power transmission/control systems as employing the principles of conduction, radiation, or convection. *ITE 4.1, 4.4*
8. Categorize specific fluid power transmission/control systems as manual, semi-automatic, or automatic. *ITE 4.4, 4.5*
9. Read sample meters/measuring devices within the designated accuracy range of thermal power transmission systems. *ITE 4.7, 4.8*
10. List and describe typical applications of thermal power transmission/control systems. *ITE 4.4, 4.5*
11. Identify the most common: energy source, conversion method, transmission path, control system, measurement device, and output of a given thermal transmission power system. *ITE 4.1, 4.3, 4.4, 4.5, 4.7, 4.8, 4.20, 4.23, 4.32*
12. Follow in all laboratory activities the applicable safety regulations. *ITE 2.18*

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
- **F. Systems of Power Transmission**
  - 5. Thermal Power Transmission Systems
    - a. Typical Energy Sources
      - (1) Sun (Solar Heating Systems)
      - (2) Fossil Fuel (Natural Gas Heating System)
      - (3) Electricity (Soldering Gun)
    - b. Typical Conversion Methods
      - (1) Solar Thermal to Air Thermal via Convection (Passive Solar Heating)
      - (2) Chemical to Air Thermal (Natural Gas Heating)
      - (3) Electrical to Thermal Via Conduction (Soldering Gun)
    - c. Transmission and/or Control Techniques
      - (1) Natural Conduction
      - (2) Natural Radiation
      - (3) Natural Convection
        - (a) Passive Systems
        - (b) Active Air Systems
        - (c) Active Water Systems
    - d. Transmission and/or Control Devices
      - (1) Heat Pumps
      - (2) Heat Exchangers
      - (3) Convection Chimney
      - (4) Plenum
      - (5) Heat Masses/Syncs
      - (6) Thermostat
    - e. Measurement
      - (1) Standard Units (Metric)
        - (a) British Thermal Unit (Watt/Calorie/ Joule)
        - (b) Fahrenheit (Celsius)
      - (2) Devices
        - (a) Thermometer
        - (b) Pyrometer
    - f. Scientific Principles
      - (1) Conduction
      - (2) Radiation
      - (3) Convection
      - (4) Greenhouse Effect

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Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of heat, BTU, super-heated, geothermal, ocean thermal, conduction, radiation, convection, and greenhouse effect.	
Participate in a class discussion related to energy sources, conversion methods, and transmission and/or control techniques and devices of thermal power transmission systems.	
Obtain two large juice cans. Paint one black, and leave one shiny. Fill both with equal amounts of water. Place a thermometer in each can and set them in the sunshine. Compare the water temperatures after one hour.	Stephenson, Power Technology, Student Manual, pp. 62; Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 71-72.
Observe a demonstration of operations necessary to build solar energy collectors.	
Heat water using a solar energy collector.	Utah, Industrial Arts-Agriculture, Curriculum Guide, "Solar Energy"; Megatech, Energy and Power Projects and Experiments, pp. 7, Megatech Corporation 29 Cook Street, Billerica, MA 01866; Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 73-74.
Construct a parabolic oven (or other solar energy collector) and conduct experiments by cooking various foods, such as potato, hot dog, etc.	Bame, Exploring Technology, Activity Manual, pp. 29-32; Todd, Understanding and Using Technology, Activity Manual, pp. 51-53.
Construct a solar central receiver.	Harms, Energy, Power, and Transportation Technology Activities, pp. 9-15.
Discuss the advantages of building a home facing south.	
Participate in a class discussion related to measurement units and devices and scientific principles of thermal power transmission systems.	
Observe a demonstration of the operations necessary to construct a thermocouple and/or a heat powered fan.	
Construct a thermocouple to demonstrate the direct conversion of energy.	Smith, Instructor's Guide For Exploring Energy, pp. 32

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
  - **F. Systems of Power Transmission**
    - **5. Thermal Power Transmission Systems**
      - g. Typical Applications
        - (1) Transportation
          - (a) Hot Air Balloon
          - (b) Temperature Gauge
          - (c) Thermostat
          - (d) Automobile Heater
        - (2) Communication
          - (a) Space Satellite
          - (b) Thermometer
          - (c) Pyrometer
        - (3) Manufacturing
          - (a) Casting Glass
          - (b) Soldering
          - (c) Welding
          - (d) Thermoforming
          - (e) Candy Making
        - (4) Construction
          - (a) Heating System
          - (b) Water Heater
          - (c) Heat Pump
      - h. Conservation of Energy Use
      - i. Impact of Thermal Power Transmission Systems

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Suggested Student Activities	**References/AV/Supplies/Equipment**
Construct and test a heat powered fan.	Smith, Instructor's Guide For Exploring Energy, pp. 30.
Observe a demonstration for the operations necessary to construct a heat exchanger and/ or a hot air balloon.	
Build a simple liquid-to-air heat exchanger. Determine temperature differential across the heat exchanger. Determine the influence of flow rate on heat exchanger efficiency.	Minnesota Department of Education, Energy Activities for Industrial Arts, Heat Exchanger.
In groups of two or three construct a hot air balloon.	Energy Technology, Booklet prepared by Dean Frame, Riverview Gardens Senior High School, St. Louis, MO.
Participate in a class discussion related to the typical applications, conservation of energy use and impacts of thermal power transmission systems.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 68-69, 74, 84, 152, 278.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 504-506.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 37, 395-396.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 401-402.
Williams, et al., Technology At Work, South-Western, 1987, pp. 114-122.

Selected Readings On Energy and Power

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 346-358.
Center For Occupational Research and Development and Agency For Instructional Technology, Principles of Technology, Teacher's Guide, Center For Occupational Research and Development, 1984.
Megatech, Energy and Power Projects and Experiments, Megatech Corporation, 29 Cook Street, Billerica, MA 01866.
Schwaller, Energy Technology: Sources of Power, Davis, 1980, pp. 250-258, 264-268.

Revision Notes:

Lesson Title: Introduction to Transportation

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this lesson each student will learn fundamental concepts and skills related to modes of transportation, historical development of transportation, and the components of our current transportation systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: transportation, vehicle, cargo, control system, guidance system, propulsion system, structural system, suspension system.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List the primary modes of transportation.
4. Describe at least ten major transportation developments which have occurred since primitive times. *ITE 4.16*
5. List the major components of a transportation system. *ITE 4.16*
6. List the sub-systems of any vehicle and describe the function of each.
7. List or select from a list the major factors concerning controlled pathways.
8. Identify and give examples of typical transportation support services.
9. State two advantages and two disadvantages for at least eight selected transportation vehicles. *ITE 2.19, 4.16*

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Content Outline **Teacher Plans and Activities**

III. Energy and Power Technology
  G. Transportation
    1. Introduction to Transportation
      a. Modes of Transportation
        (1) Stationary Conveyance Systems
        (2) Land Transportation
        (3) Water Transportation
        (4) Air Transportation
        (5) Space Transportation
      b. Components of Transportation Systems
        (1) Vehicles
          (a) Propulsion Systems
          (b) Control Systems
          (c) Guidance Systems
          (d) Suspension Systems
          (e) Structural Systems
        (2) Controlled Pathways
          (a) Planning and Design
          (b) Construction
          (c) Management
        (3) Support Services
          (a) Energy Supply
          (b) Vehicle Maintenance
          (c) Pathway Maintenance
          (d) Safety Assurance
          (e) Finance of Pathways
          (f) Regulations
          (g) Guidance Systems
      c. Historical Development
        (1) Primitive Transportation
        (2) Modern Transportation
        (3) Transportation Trends

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of transportation, vehicle, cargo, control system, guidance system, propulsion system, structural system, and suspension system.	
Participate in a class discussion related to modes of transportation, components of transpotation systems, and historical development of transportation.	
Measure the pull on a fish scale and chart the force needed to carry a 25-pound object, drag the weight on a travois or sled, and pull the object in a child's wagon to compare the relative efficiency of each primitive mode of transportation.	
In small groups develop a bulletin board display showing the modes of transportation, systems of vehicles, types of control pathways, and/or transportation support services.	
Search magazine articles to obtain pictures of examples of specific components of a transportation system. Use these pictures to develop a poster identifying the types of propulsion system, control system, guidance system, etc. used by the mode of transport selected.	
Draw a chart showing the chronological order of the development of at least twenty transportation modes. Add the most significant of these vehicles to the timeline (see Unit I Lesson 3).	
Make a model of a "period" transportation vehicle.	DeOld, Transportation: The Technology of Moving People and Products, pp. 26..
Visit a museum of transportation vehicles.	

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
- **G. Transportation**
  - **1. Introduction to Transportation**
    - d. Analysis of Transportation Modes (Systems)
      - (1) Advantages
      - (2) Disadvantages
      - (3) Selecting Optimal Modes of Transportation
        - (a) Cost
        - (b) Time
        - (c) Distance
        - (d) Man-made Barriers
        - (e) Natural Barriers
        - (f) Type of Cargo
        - (g) Volume of Cargo
        - (h) Weight of Cargo
        - (i) Value of Cargo
        - (j) Packaging Requirements
        - (k) Handling Requirements
        - (l) Personnel Comfort
        - (m) Personnel Safety

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to the analysis of transportation modes.	
Complete a mode of transportation worksheet which draws comparisons between various transportation systems and the components they contain.	Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 123-124.
Play "trivial pursuit" using transportation facts.	Goetsch, Technology and You, pp. 434-438; Spacek, Kim and Melvin J. Pedras, "Using Trivial Pursuit To Enhance Technology Education", The Technology Teacher, November 1987, pp. 32-33.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 175-180.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 218-229, 258-264, 280-293.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 177-184, 198-216,
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 613-615.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 437-445.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 259-267.
Heiner, et al., People Create Technology, Davis, 1980, pp. 151-152.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 378-381.
Minton, et al., Teaching Technology to Children, Davis, 1987, pp. 127-132, 405-406.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 175-191.
Williams, et al., Technology At Work, South-Western, 1987, pp. 198-201.

Selected Readings On Transportation

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 157-184.
DeOld, et al., Transportation: The Technology of Moving People and Products, Davis, 1986, pp. 3-26.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-145-E to ETE-184-E.

Revision Notes:

Lesson Title: Land and Water Transportation

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to the vehicles, pathways and support systems appropriate to the movement of people and cargo using land and water transportation systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: mode, American Travel Track (AMTRAK), bulk cargo, classification yard, piggyback, rolling stock, inland waterway, canal, lock, inter-coastal waterway, barge, hydrofoil, hovercraft, submersible, NAVSAT (NAVigation via SATellite positioning).
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Label the component parts of a typical conveyor system and a typical elevator system.
4. Match land and water transport vessels with appropriate products and cargo. *ITE 4.16*
5. Match name with major use and with photo of selected land and water vehicles. *ITE 4.16*
6. Diagram and explain the operating principles of a canal lock. *ITE 4.19*
7. Compare the advantages and disadvantages of water transport with land transport modes. *ITE 4.16*
8. Explain the interdependence among the various water and land modes of transportation. *ITE 4.16*
9. List ten items used in everyday life which were transported at some stage by water vessel.
10. Distinguish between primary and secondary highway systems. *ITE 4.16*
11. Describe the importance of standardization among rail and highway systems in the U.S., Canada, and Mexico. *ITE 4.16*
12. Identify "controlled pathways" which have been designated on major waterways. *ITE 4.16*
13. Identify the support systems necessary for highway, rail and water transportation systems. *ITE 4.16*
14. Construct a water and/or a land transportation device. *ITE 2.19, 4.11, 4.12, 4.16, 4.20*
15. State the role of safety assurance programs in the movement of people and cargo.
16. Follow in all laboratory activities the applicable safety regulations. *ITE 2.18*

Content Outline | **Teacher Plans and Activities**

- **III. Energy and Power Technology**
  - **G. Transportation**
    - 2. Land and Water Transportation Systems
      - a. Stationary Conveyance Systems
        - (1) Devices To Move People
          - (a) Elevators
          - (b) Escalators
          - (c) Personal Rapid Transit (PRTs)
          - (d) Cable Cars
        - (2) Devices To Move Cargo
          - (a) Conveyors
          - (b) Pipelines
          - (c) Robots
          - (d) Specialized Devices
        - (3) Basic Operation Principles
        - (4) Support Systems
          - (a) Maintenance
          - (b) Safety Assurance
      - b. Land Transportation Systems
        - (1) Vehicles
          - (a) Automobiles
          - (b) Trucks
          - (c) Railroad Cars
          - (d) Busses
          - (e) Bicycles
          - (f) Carts/Wagons
          - (g) Tractors
          - (h) Recreational Vehicles
          - (i) Other
        - (2) Controlled Pathways
          - (a) Highways
          - (b) Railways
          - (c) Tubes
        - (3) Support Systems
          - (a) Energy Supply
          - (b) Vehicle Maintenance
          - (c) Pathway Maintenance
          - (d) Safety Assurance
          - (e) Finance of Pathways
          - (f) Regulations
          - (g) Guidance Systems

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of terms in competency #1.	
Participate in a class discussion related to stationary conveyance systems.	Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 23-36.
Participate in a class discussion related to land transportation systems, and water transportation systems.	
Complete a worksheet matching products to be transported with appropriate land and water transportation vehicles.	
Complete a worksheet matching the name, the use, and a photo of various land and water vehicles.	
Observe a demonstration showing the operations necessary to design and construct the race car.	
Design and build a race car. Design competition and racing competition could be added at the discretion of the teacher.	Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 89-92; MAVCC, Exploring Energy, Power, and Transportation Technology, pp. EEPT-325 to EEPT-332.
View films or video tapes on the history and use of railroads, such as "Railroads" Parts I and II.	Kaw Valley, Films and Video, P.O. Box 3900, 6532 Switzer, Shawnee, KS 66203 (45 minutes; purchase $29.95 each)
Participate in a field trip to view transportation operations, such as a railroad switching yard, a model railroad layout, a trucking warehouse, a river lock and dam, a suburban mass transit center, a barge loading dock, a grain elevator, etc.	
Participate in a presentation by a guest speaker from a land or water transportation firm, such as a pipeline company, rail company, trucking company, elevator installer, highway patrol, water safety patrol, etc.	

Content Outline	Teacher Plans and Activities
III. Energy and Power Technology	
G. Transportation	
2. Land and Water Transportation Systems	
c. Water Transportation Systems	
(1) Vehicles	
(a) Boats	
(b) Ships	
(c) Barges	
(d) Hydrofoils	
(e) Hovercrafts	
(f) Submersibles	
(2) Controlled Pathways	
(a) Inland Waterways	
(b) Sea Lanes	
(c) Canals	
(3) Support Systems	
(a) Energy Supply	
(b) Vehicle Maintenance	
(c) Pathway Maintenance	
(d) Safety Assurance	
(e) Finance of Pathways	
(f) Navigation	
(g) Regulations	

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Suggested Student Activities	References/AV/Supplies/Equipment
Observe a demonstration showing the operations necessary to construct the selected land or water vehicle or model.	
Design and construct a simple submersible vehicle.	Harms, Energy, Power, and Transportation Technology Activities, pp. 4-8.
Construct a land or water vehicle or model, such as an air cushion vehicle, a Maglev vehicle, an electric car, a prototype bus, an airboat, a lock, a high energy speedboat, a jet-propelled rail car, a personalized rapid transit system, an elevator, a yacht, a monorail car, a windsail vehicle, a tow vehicle, a "robocar", or a hydroplane boat.	DeOld, Transportation, Activity Manual, pp. 19-20, 23-26, 37-38, 41-42, 89-91, 99-100, 103-106; Bohn, Energy, Power and Transportation Technology, Activity Guide, pp. 79-82, 100; Harms, Energy, Power, and Transportation Technology Activities, pp. 16-20; Hacker, Living With Technology, pp. 78-79, 470-473; Heiner, People Create Technology, Activity Guide, Activity #23; Teacher's Laboratory Catalog, pp. 14.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 186-203, 208-212, 216-219, 221-223.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 233-257, 266-279.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 184-194.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 615-617.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 445-455, 463-465.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 267-277, 285-287.
Heiner, et al., People Create Technology, Davis, 1980, pp. 152-162, 165-166.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 381-388, 394-404.
Minton, et al., Teaching Technology to Children, Davis, 1987, pp. 132-164.
Williams, et al., Technology At Work, South-Western, 1987, pp. 202-220.

Selected Readings On Transportation

Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 186-209, 223-242, 274-344.
DeOld, et al., Transportation: The Technology of Moving People and Products, Davis, 1986, pp. 29-185, 189-279, 457-483, 485-493.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-145-E to ETE-184-E.
Railways, Macdonald and Company, 3rd Floor Greater London House, Hampstead Road, London NWI 7QX.
Road Travel, Macdonald and Company, 3rd Floor Greater London House, Hampstead Road, London NWI 7QX.
Ships, Macdonald and Company, 3rd Floor Greater London House, Hampstead Road, London NWI 7QX.

Lesson Title: Air and Space Transportation

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this lesson each student will learn fundamental concepts and skills related to the vehicles, pathways and support systems appropriate to the movement of people and cargo using air and space transportation systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: fuselage, vertical and horizontal stabilizer, aileron, rudder, elevator, empennage, angle of attack, flaps, slots, slats, spoiler, tab, IFR, VFR, VTOL, STOL, flight plan, FAA flight service station, air traffic control, apogee, interplanetary, lunar, module, payload, rendezvous, satellite, Skylab, Space Shuttle, staging, trajectory.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Match the function of aircraft components with the component name. *ITE 4.19*
4. Describe the interrelationship of weight, lift, drag, and thrust as an airstream passes an airfoil.
5. Distinguish among turbojet, turbofan, turboprop, turboshaft, and reciprocating engine aircraft. *ITE 4.12*
6. Distinguish among general aviation, commercial aviation, and military aviation. *ITE 4.16*
7. Match the names of air and space vehicles with their functions and photos. *ITE 4.16, 4.19*
8. Name and explain the controlled pathways applicable to air and space transportation.
9. List the support systems necessary for safe and efficient operation of air and space transportation.
10. List the activities of the FAA to ensure safety in general and commercial aviation.
11. List manned and unmanned space vehicles which are currently operational.
12. Distinguish between orbital and sub-orbital pathways. *ITE 4.16*
13. Explain the difference between liquid fuel and solid fuel energy supplies. *ITE 4.12*
14. Identify standard maintenance requirements for typical space vehicles. *ITE 4.16*
15. List typical space pathway maintenance requirements. *ITE 4.16*
16. Identify major space travel safety assurance considerations. *ITE 4.16*
17. Construct an air and/or a space transportation device. *ITE 2.19, 4.11, 4.12, 4.16, 4.20*
18. Follow in all laboratory activities the applicable safety regulations. *ITE 2.18*

Content Outline | **Teacher Plans and Activities**

- **III. Energy and Power Technology**
  - **G. Transportation**
    - 3. Air and Space Transportation Systems
      - a. Air Transportation Systems
        - (1) Vehicles
          - (a) Fixed Wing
          - (b) Rotary Wing
          - (c) Lighter Than Air
        - (2) Controlled Pathways
          - (a) Airways
          - (b) Runways
          - (c) Taxi Ways
        - (3) Support Systems
          - (a) Energy Supply
          - (b) Vehicle Maintenance
          - (c) Pathway Maintenance
          - (d) Safety Assurance
          - (e) Finance of Pathways
          - (f) Regulations
          - (g) Guidance Systems

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of terms in competency #1.	
Participate in a class discussion related to air transportation and space transportation vehicles systems.	
Complete a worksheet matching aircraft components with the component name.	
Given a cutaway drawing of an airfoil, label the flight components and their direction of force for weight, thrust, drag, and lift. Explain in narrative what each component is and what creates it.	
Using a series of sectioned drawings of a turbojet engine, modify by sketching to depict the physical characteristics of a turbofan engine, turboprop engine, and a turboshaft engine.	DeOld, Transportation: The Technology of Moving People and Products, Activity Manual, pp. 51-52.
Participate in a class discussion related to general, commercial, and military aviation as well as the role of the FAA in aviation.	
Complete a worksheet matching the names of air and space vehicles with their functions and photos.	
Participate in a class discussion related to the controlled pathways and the support systems necessary for air and space transportation.	
As a member of a small group, construct a display that demonstrates air and space transportation, such as the staging sequence of rockets, the launching of an unmanned satellite, various life support systems necessary for travel in space, the types of lighter-than-air vehicles, the operation of rotary-wing aircraft, the components of an airport, the components of a space station, or the launching and landing of a space shuttle.	DeOld, Transportation: The Technology of Moving People and Products, Activity Manual, pp. 3-4, 71-74, 77-78, 81-84; "NASA Audio Visual Catalog", National Aeronautics and Space Administration, Marshall Space Flight Center, AL 35812.
View film or video tape from NASA showing launch and recovery of a space vehicle.	National 4-H Center, 7100 Connecticut Avenue, Chevy Chase, MD 20815.
View a film or video tape on spin offs of space technology, such as "Blue Sky Below My Feet--Adventure In Space Technology".	

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
  G. Transportation
    3. Air and Space Transportation Systems
      b. Space Transportation Systems
        (1) Vehicles
          (a) Manned
          (b) Unmanned
        (2) Controlled Pathways
          (a) Orbital
          (b) Sub-Orbital
        (3) Support Systems
          (a) Energy Supply
          (b) Vehicle Maintenance
          (c) Pathway Maintenance
          (d) Safety Assurance
          (e) Finance of Pathways
          (f) Regulations
          (g) Guidance Systems

Suggested Student Activities	References/AV/Supplies/Equipment
Observe a demonstration showing the operations necessary to construct a transportation device along a given pathway.	
Design and construct a transportation device transporting a chicken egg along a given pathway.	Fales, Technology: Today and Tomorrow, pp. 296-298.
Observe a demonstration showing the operations necessary to build and fly a hand-launched glider.	
Complete activity, "Building and Flying a Hand-Launched Glider".	DeOld, Transportation: The Technology of Moving People and Products, Activity Manual, pp. 63-64; Fales, Technology: Today and Tomorrow, pp. 302-304.
Observe a demonstration showing the operation necessary to construct and test an airfoil wind stand and a wind tunnel.	
As a group activity, design, construct and test an "Airfoil Wind Stand " and "A Wind Tunnel".	DeOld, Transportation: The Technology of Moving People and Products, Activity Manual, pp. 3-6, 53-56, 61-62.
Observe a demonstration showing the operations necessary to construct and launch a model rocket.	
Construct, launch, and test a model rocket.	Bohn, Energy, Power and Transportation Technology, Activity Guide, 1986, pp. 125-129; Bame, Exploring Technology, Activity Manual, pp. 53-55; DeOld, Transportation: The Technology of Moving People and Products, Activity Manual, pp. 7-10; Fales, Technology: Today and Tomorrow, pp. 304-311.
Observe a demonstration showing the operations necessary to construct a selected air and space transportation vehicle or model.	
Construct an air or space transportation vehicle or model, such as a model space craft, a model lunar rover vehicle, a model space station, a boomerang, or a VTOL aircraft.	DeOld, Transportation: The Technology of Moving People and Products, Activity Manual, pp. 67-68, 75-76, 79-82; Harms, Energy, Power, and Transportation Technology Activities, pp. 21-24; APPENDIX A.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 180-186, 203-208, 214-216, 219-220, 223.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 231-233.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 194-197.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 617-619.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 456-463.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 278-285.
Heiner, et al., People Create Technology, Davis, 1980, pp. 162-165.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 389-394.
Minton, et al., Teaching Technology to Children, Davis, 1987, pp. 164-183.
Williams, et al., Technology At Work, South-Western, 1987, pp. 221-224.

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Air Travel, Macdonald and Company, 3rd Floor Greater London House, Hampstead Road, London NWI 7QX.
Apfel, Necia. Space Station, 1987, Franklin Watts, 387 Park Ave. South, NY, NY 10016.
Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 210-222, 375-376.
Couper, Heather, and Nigel Henbest, Space Probes and Satellites, 1987, Franklin Watts, 387 Park Ave. South, NY, NY 10016.
DeOld, et al., Transportation: The Technology of Moving People and Products, Davis, 1986, pp. 283-381, 385-453, 495-508, 510-519.
Jeffries, David, Satellites, 1987, Franklin Watts, 387 Park Ave. South, NY, NY 10016.
Mid-America Vocational Curriculum Consortium, Inc., Exploring Technology Education, Mid-America Vocational Curriculum Consortium, 1987, ETE-145-E to ETE-184-E.
Richard, Graham, Helicopters, 1987, Franklin Watts, 387 Park Ave. South, NY, NY 10016.
Space Travel, Macdonald and Company, 3rd Floor Greater London House, Hampstead Road, London NWI 7QX.
Stern, Alan, The US Space Program After Challenger, 1987, Franklin Watts, 387 Park Ave. South, NY, NY 10016.
"The Gyroscope Through The Ages", Sperry Flight Systems, P.O. Box 2111, Phoenix, AZ 85036.
Vogt, Gregory, Space Laboratories: Space Satellites, 1987, Franklin Watts, 387 Park Ave. South, NY, NY 10016.

Lesson Title: Selected Emerging Areas: Energy and Power Technology

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to several significant examples of emerging developments in energy and power technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: cryogenics, artificial intelligence, magnetic levitation, thermograph, robot, pollution, lasers, superconductivity.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List or select from a list energy, power and transportation devices/services that have been developed in the past decade. *ITE 4.19*
4. List or select from a list applications of energy and power resulting from the space program which are presently used in other aspects of our society. *ITE 4.19*
5. State at least two examples of the use of automation in power conversion and in transportation. *ITE 4.19*
6. Identify at least two uses of lasers and of robotics in power conversion and in transportation. *ITE 4.17, 4.19*
7. Explain how energy usage and conversion affects the environment and list ways to protect the environment from the effects of poor energy utilization. *ITE 2.8*
8. State at least one potential trend in energy and power technology. *ITE 4.19*
9. Recognize that technological change is continuous, has an effect on humans, and is brought about by human action; therefore, each individual may assume a responsible role in directing technological change. *ITE 2.19*
10. Gather pertinent information, formulate and express an opinion related to the social/cultural issues in energy and power technology. *ITE 2.7, 2.8, 2.9*
11. Write a scenario of energy usage in the year A.D. 2500. *ITE 2.13, 2.19*

Content Outline	Teacher Plans and Activities

III. Energy and Power Technology
  H. Selected Emerging Areas
    1. Energy Conversion Systems
      a. Cryogenics
      b. Solar
      c. Thermal
      d. Biomass
      e. Other
    2. Systems of Power Transmission
      a. Artificial Intelligence
      b. Robotics
      c. Lasers
      d. Thermographs
      e. Fiber Optics
      f. Magnetic Levitation
      g. Superconductivity
      h. Other
    3. Transportation Systems
      a. Stationary Conveyance Systems
      b. Land Vehicles
      c. Water Vehicles
      d. Aircraft
      e. Space Vehicles
      f. Aerodynamics
      g. Other
    4. Potential Trends in Energy and Power Technology
      a. Increased Use of Solar Energy
      b. Increased Use of Computers
      c. Increased Environmental Consequences and Concerns
      d. Increased Recycling of Waste Materials
      e. Decrease in Use of Human and Animal Power
      f. Increase in Electrical Power
      g. Concern About Fluid Dynamics In Vehicle Design
      h. Other
    5. Current Social/Cultural Issues In Energy and Power Technology
      a. Nuclear Energy/Waste
      b. Pollution/Acid Rain/ Green House Effect
      c. Depletion of Fossil Fuels
      d. Standard of Living/High Energy Use
      e. Noise Pollution
      f. Auto Industry/Economy
      g. Space Rights/Pollution
      h. Space Program/Risks
      i. Robotics/Replacing Humans In the Work Place
      j. Other

Superconductivity Kit available for $25 from: Project 1-2-3, Institute for Chemical Education, Department of Chemistry, University of Wisconsin-Madison, Madison, WI 53706

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Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Maintain a diary throughout this lesson making entries which reflect individual thoughts and opinions related to how the topics affect the individual, what feelings they have related to the perceived effects, and what related action they might like to take.	
Participate in a class discussion related to definition of terms in competency #1, new energy sources, new energy conversion methods, new power transmission techniques, and new transportation applications used in industry, the school and the home.	
View a film or video tape related to new concepts, devices and services in energy and power technology, such as "Energy: The Problems and The Future".	National Geographic Educational Service, c/o Karol Media, 22 Riverview Drive, Wayne, NJ 07470 (23 minutes, free preview, $35 for three day rental).
Participate in a class presentation led by a representative of an energy conversion firm, a transportation firm, or a vehicle manufacturing firm on the subject of emerging energy and power technology.	
Demonstrate to the class how a selected product represents current energy and power technology; or describe the findings of an article from a recent periodical related to current energy and power technology. Your report should include: a description of the source, it's potential for use at the community, national, and international level, and potential problems with the use of the source.	Bohn, Energy, Power and Transportation Technology, pp. 32.
Select a topic and write a report on an emerging area in the field of energy and power.	
Participate in a class discussion on energy use in the year A.D. 2500 and make a model of a transportation vehicle or device that may be in use by that time.	
Participate in a class discussion on the effects of a total absence of fossil fuels, on the expanded use of biomass, and on energy waste/environmental pollution in your community. Suggest ways that energy waste and environmental pollution can be reduced or eliminated.	
Make a poster showing different products which are used to help reduce pollution from various energy sources.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

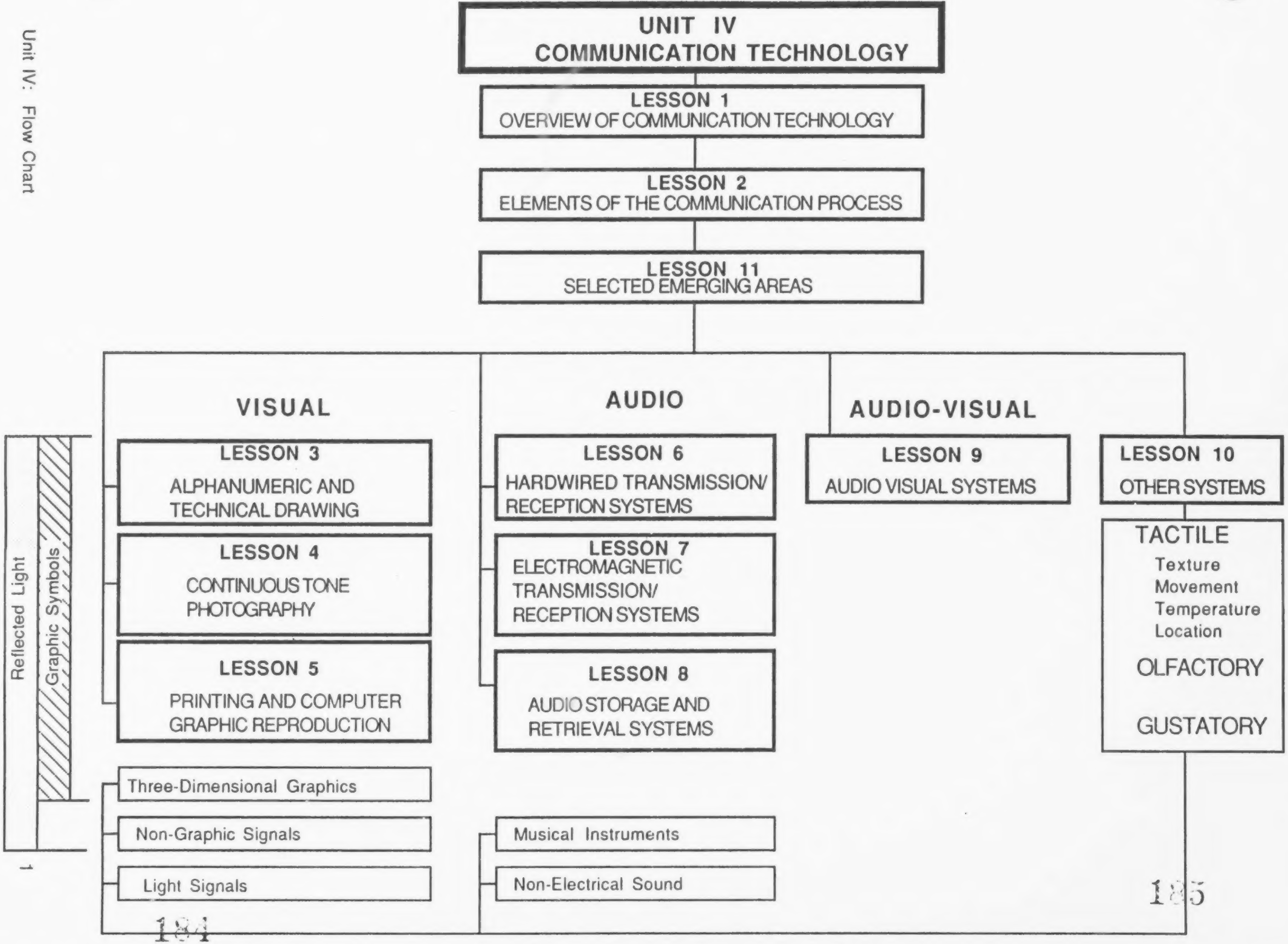
Bame, et al., Exploring Technology, Davis, 1980, pp. 275-279.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 280-293.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 401-410, 413-432.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 499-501, 504.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 375-377, 380.
Heiner, et al., People Create Technology, Davis, 1980, pp. 229-246.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 183-189.
Williams, et al., Technology At Work, South-Western, 1987, pp. 230-233.

Selected Readings On Energy and Power

Aleksander, Igor, and Piers Burnett. Thinking Machines: The Search For Artificial Intelligence, Kophf.
Bohn, et al., Energy, Power and Transportation Technology, Bennett and McKnight, 1986, pp. 345-376.
Lampert, Mark. Transportation In The Future, Franklin Watts, 387 Park Avenue South, NY, NY 10016., 1986.

Most issues of Popular Science will show new developments in energy and power technology

Revision Notes:


UNIT IV
COMMUNICATION TECHNOLOGY
LESSON 1
OVERVIEW OF COMMUNICATION TECHNOLOGY
LESSON 2
ELEMENTS OF THE COMMUNICATION PROCESS
LESSON 11
SELECTED EMERGING AREAS
VISUAL
AUDIO
AUDIO-VISUAL
LESSON 3
ALPHANUMERIC AND TECHNICAL DRAWING
LESSON 4
CONTINUOUS TONE PHOTOGRAPHY
LESSON 5
PRINTING AND COMPUTER GRAPHIC REPRODUCTION
Three-Dimensional Graphics
Non-Graphic Signals
Light Signals
Reflected Light
Graphic Symbols
LESSON 6
HARDWIRED TRANSMISSION/ RECEPTION SYSTEMS
LESSON 7
ELECTROMAGNETIC TRANSMISSION/ RECEPTION SYSTEMS
LESSON 8
AUDIO STORAGE AND RETRIEVAL SYSTEMS
Musical Instruments
Non-Electrical Sound
LESSON 9
AUDIO VISUAL SYSTEMS
LESSON 10
OTHER SYSTEMS
TACTILE
Texture
Movement
Temperature
Location
OLFACTORY
GUSTATORY

IV. Communication Technology

A. Overview of Communication Technology
  1. Definitions
    a. Communication
    b. Optical/Visual
    c. Graphic
    d. Acoustical/Audio
    e. Broadcasting
    f. Telecommunication
    g. Audio-Visual
  2. Importance of Communication Technology
  3. Communication Systems Model
  4. Relationship of Other Curricular Areas to Communication Technology
    a. Scientific Principles
    b. Mathematical Applications
    c. Social/Cultural Interaction
    d. Language Arts Applications
  5. Timeline of Communication
    a. Pre-Renaissance
      (1) Egyptians
      (2) Babylonians
      (3) Phoenicians
      (4) Chinese
      (5) Greeks
      (6) Romans
    b. Renaissance
      (1) Integration of Printing Technology Components
        (a) Movable Type
        (b) Lockup System
        (c) Press
        (d) Paper
        (e) Ink
        (f) Usable Alphabet
      (2) Attitude Toward Technological Development
    c. Industrial Revolution
      (1) Control of Electricity
      (2) Linotype
      (3) Telegraph
      (4) Telephone
      (5) Phonograph
      (6) Daguerreotype
      (7) Wireless Telegraph
      (8) Kinetoscope
      (9) Box Camera/Roll Film
      (10) Postal System

- d. Twentieth Century
    - (1) Radio
    - (2) Television
    - (3) Computer
    - (4) Instant Camera
    - (5) Radar/Sonar
    - (6) Disk/Tape Recorder
- e. Space Age
    - (1) Transistor
    - (2) Satellite
    - (3) Integrated Circuit
    - (4) Fiber Optics
    - (5) Personal Computer
    - (6) Compact Disk

6. Special Safety Concerns
    - a. Potential Hazards
    - b. Equipment Safety Guards
    - c. Personal Protective Equipment
    - d. Past Records
7. Careers in Communication
    - a. Selected Communication Occupations
        - (1) Commercial Art and Design
            - (a) Designer
            - (b) Layout Artist
            - (c) Art Director
        - (2) Photography
            - (a) Press Photographer
            - (b) Freelance Photographer
            - (c) Commercial Photographer
            - (d) Portrait Photographer
        - (3) Engineering Drafting and Design
            - (a) Designer
            - (b) Drafter
            - (c) Checker
            - (d) CAD Technician
        - (4) Printing and Publishing
            - (a) Writer
            - (b) Editor
            - (c) Process Camera Photographer
            - (d) Press Operator
            - (e) Typesetter
            - (f) Bindery Worker
        - (5) Advertising
            - (a) Graphic Artist
            - (b) Writer
            - (c) Salesperson

            - (6) Broadcasting
                - (a) Writer
                - (b) Reporter
                - (c) Engineer
                - (d) Disc Jockey
                - (e) Audio Technician
                - (f) Lighting Technician
                - (g) Camera Technician
                - (h) Producer
                - (i) Director
            - (7) Cinematography
                - (a) Set Designer
                - (b) Camera Technician
                - (c) Audio Technician
                - (d) Lighting Technician
                - (e) Writer
                - (f) Director
                - (g) Film Editor
            - (8) Telecommunication
                - (a) Telephone Operator
                - (b) Installation and Repair Specialist
                - (c) Line Construction and Maintenance Workers
                - (d) Central Office Installers
    - 8. Regulation of Communication
        - a. Federal Communication Commission
        - b. Federal Trade Commission
        - c. American National Standards Institute
        - d. National Association of Broadcasters
- B. Elements of the Communication Process
    - 1. Pre-Processing
        - a. Message Analysis and Design
            - (1) Who/What Will Send/Receive the Message?
                - (a) Human-to-Human
                - (b) Human-to-Machine
                - (c) Machine-to-Human
                - (d) Machine-to-Machine
            - (2) What Is the Message?
            - (3) Why Is the Message Needed?
                - (a) To Inform
                - (b) To Instruct
                - (c) To Persuade
                - (d) To Entertain
                - (e) To Control Machines and Tools
            - (4) Where Will the Message Be Transmitted/Received?
                - (a) Short Range (Direct)
                - (b) Intermediate Range (Amplification Required)
                - (c) Long Range (Telecommunication)
            - (5) When Will the Message Be Transmitted/Received?
                - (a) Short Term (Immediate)
                - (b) Long Term (Storage and Retrieval)

- b. Message Creation
  - (1) Write Script (Audio)
  - (2) Sketches (Visual)
    - (a) Thumbnail
    - (b) Rough
    - (c) Comprehensive
  - (3) Design Principles (Visual)
    - (a) Balance
    - (b) Proportion
    - (c) Harmony
    - (d) Contrast
    - (e) Rhythm
    - (f) Unity
  - (4) Storyboarding (Audio/Visual)
- 2. Processing
  - a. Message Encoding
    - (1) Symbols or Signals As Codes
    - (2) Coding Source
      - (a) Human
      - (b) Machine
    - (3) Type of Code
      - (a) Light (Lights, Objects, Body Action, Alphabets, Lines, Tones, Colors)
      - (b) Sound (Spoken Language, Music Tones)
      - (c) Electrical
      - (d) Electromagnetic
      - (e) Combination
      - (f) Other
    - (4) Must Match Receiver's Code
  - b. Message Transmission
    - (1) Electromagnetic Spectrum Relationship
    - (2) Medium(s) Used
      - (a) Solid
      - (b) Fluid
      - (c) Atmosphere
      - (d) Space
  - c. Message Reception
    - (1) Direct Sensory Perception
      - (a) Sight
      - (b) Hearing
      - (c) Touch
      - (d) Taste
      - (e) Smell
    - (2) Extra Sensory Perception
    - (3) Indirect Retrieval
  - d. Message Decoding
    - (1) Type of Code
    - (2) Decoding Source
      - (a) Human
      - (b) Machine
  - e. Message Storage and Retrieval

- f. Interference
  - (1) Natural(Mechanical)
    - (a) Noise
    - (b) Distortion
    - (c) Disruption
  - (2) Man-Made (Psychological, Semantic)
    - (a) Noise
    - (b) Distortion
    - (c) Disruption
- 3. Post-Processing
  - a. Feedback
    - (1) Direct
    - (2) Indirect
      - (a) Short Term (Reactions)
      - (b) Long Term (Activities)
  - b. Redundancy
  - c. Impact
    - (1) Personal Level
    - (2) Community Level
    - (3) National Level
    - (4) International Level
- C. Optical (Visual) Communication Systems
  - 1. Reflected Light--Graphic Symbols
    - a. Pictographs
    - b. Alphanumeric Symbols/Messages
      - (1) Alphabets
      - (2) Numerals
        - (a) Decimal
        - (b) Quinary
        - (c) Binary
        - (d) Duodecimal
      - (3) Equipment and Materials
        - (a) Quill/Brush and Papyrus
        - (b) Chisel and Stone
        - (c) Stylus and Clay
        - (d) Pencil/Ink and Paper
        - (e) Moveable Type
        - (f) Typewriter
        - (g) Abacus
        - (h) Slide Rule
        - (i) Computer
      - (4) Impacts
        - (a) Extend Communication
        - (b) Stimulate Trade
        - (c) Allow Record Keeping
        - (d) Provide Personal Enjoyment
        - (e) Encourage Cultural Exchange
        - (f) Broad Based Standardization
    - c. Technical Drawing Symbols/Messages
      - (1) Drawing Sub-Systems
        - (a) Pictorial
        - (b) Orthographic
        - (c) Schematic

- (2) Production Sequence
  - (a) Plan Layout and Content
  - (b) Make Original Drawing
  - (c) Check Accuracy
  - (d) Make Copies
  - (e) Fasten or Mount Copies
  - (f) Store Original
- (3) Basic Purposes
  - (a) Show Shape
  - (b) Show Size
  - (c) Show Relationships
  - (d) Show Characteristics
- (4) Equipment and Materials
  - (a) Pencils
  - (b) Pen and Ink
  - (c) Graph Paper
  - (d) Drafting Vellum
  - (e) Drafting Film
  - (f) T-Squares and Triangles
  - (h) Scales
  - (i) Templates
  - (j) Drafting Machines
  - (k) Diazo Printer
  - (l) Computer/Tablet/Plotter
  - (m) Other
- (5) Basic Principles
  - (a) Sketching
  - (b) Instrument Drawing
  - (c) Computer Aided Drawing/CAD
  - (d) Linear Measurement
  - (e) Line Weights and Codes
  - (f) Orthographic Projection
  - (g) Pictorial
  - (h) Lettering
  - (i) Dimensioning
  - (j) Rendering
  - (k) ANSI Standards
- (6) Applications
  - (a) Record Product and Structure Design
  - (b) Convey Design Ideas
  - (c) Graph Data
  - (d) Map Geographical and Political Areas
  - (e) Show Electrical Components
  - (f) Chart A Musical Score
  - (g) Diagram Athletic Plays
  - (h) Diagram Computer Flow Charts
  - (i) Identify Product Parts/Assembly/Repair
  - (j) Other

- (7) Impact
  - (a) Communication in Manufacturing and Construction
  - (b) Standardization of Parts
  - (c) Consumer Maintenance and Repair
  - (d) Influenced the Economy
  - (e) Provided Military Weapon
  - (f) Provide Historical Records
  - (g) Provide Artistic Expression
  - (h) Other

d. Continuous Tone Photographic Symbols/Messages

- (1) Photographic Sub-Systems
  - (a) Black & White Negative
  - (b) Color Negative
  - (c) Color Transparency
  - (d) Motion
  - (e) Instant
  - (f) Photo-Video Imaging
  - (g) Holography
  - (h) Radiography/X-Ray
  - (i) Thermography/Infrared
- (2) Production Sequence
  - (a) Image Composition
  - (b) Image Exposure
  - (c) Image Conversion
  - (d) Image Reproduction
  - (e) Image Presentation
- (3) Equipment and Materials
  - (a) Cameras
  - (b) Lenses and Filters
  - (c) Lights and Meters
  - (d) Enlargers and Contact Printers
  - (e) Film Processors
  - (f) Film
  - (g) Processing Chemicals
  - (h) Print Paper
  - (i) Other
- (4) Basic Principles
  - (a) Composition
  - (b) Camera Operation
  - (c) Exposure Control
  - (d) Film Composition
  - (e) Filter Selection
  - (f) Chemical Processing
  - (g) Holography
  - (h) Radiography and Thermography
- (5) Applications
  - (a) Recording of History
  - (b) Education
  - (c) Recreation
  - (d) Advertising
  - (e) Decoration
  - (f) Entertainment
  - (g) Other

- (6) Impact
  - (a) Expand Time, Location and Size Awareness
  - (b) Provide Personal and Historical Records
  - (c) Provide Personal Enjoyment
  - (d) Influence Economy
  - (e) Influence Consumer Choices
  - (f) Potential for Being Abusive/Misleading
  - (g) Provide for Artistic Expression
  - (h) Other

e. Printed Graphic Reproduction

- (1) Image Transfer Sub-Systems
  - (a) Relief Printing
  - (b) Planographic Printing
  - (c) Intaglio Printing
  - (d) Stencil Printing
  - (e) Ink Jet Printing
  - (f) Electrostatic Copying
  - (g) Diazo Copying
  - (h) Spirit Duplicating
  - (i) Stencil Duplicating
  - (j) Facsimile Transmission
- (2) Production Sequence
  - (a) Perform Message Analysis
  - (b) Create Design
  - (c) Generate Image
  - (d) Assemble Image
  - (e) Convert Image
  - (f) Prepare Image Carrier
  - (g) Transfer Image
  - (h) Finish/Bind Product
- (3) Equipment and Materials
  - (a) Process Cameras
  - (b) Presses/Duplicators
  - (c) Light Tables
  - (d) Word Processors
  - (e) Folders
  - (f) Paper Cutters
  - (g) Fasteners
  - (h) Paper/Substrates
  - (i) Film
  - (j) Ink
  - (k) Chemicals
  - (l) Other
- (4) Basic Principles
  - (a) Message Analysis
  - (b) Design Principles
  - (c) Image Generation
  - (d) Image Assembly
  - (e) Camera Operation
  - (f) Exposure Control
  - (g) Film Composition
  - (h) Chemical Processing
  - (i) Halftone /Color Separation
  - (j) Image Carrier Preparation

        - (k) Press/Duplicator/Copier Operation
        - (l) Finishing/Binding Operations
        - (m) Paper and Ink Production
        - (n) Cost Estimation
    - (5) Applications
        - (a) Recording of History
        - (b) Education
        - (c) Advertising
        - (d) Decoration
        - (e) Entertainment
        - (f) Identification
        - (g) Other
    - (6) Impact
        - (a) Free Press and Democracy
        - (b) Expand Time and Location Awareness
        - (c) Provide Personal and Historical Records
        - (d) Provide Personal Enjoyment
        - (e) Influence the Economy
        - (f) Influence Consumer Choices
        - (g) Potential for Being Abusive/Misleading
        - (h) Provide for Artistic Expression
        - (i) Potential for Large Quantities of Waste Material
        - (j) Other
- f. Computer Generated Graphic Reproduction
    - (1) Graphic Output Sub-Systems
        - (a) Computer Printing/Desktop Publishing
        - (b) Computer Plotting
        - (c) Computer Generated Slides
        - (d) Microform Storage of Computer Data
    - (2) Production Sequence
        - (a) Perform Message Analysis
        - (b) Create Design
        - (c) Generate Image
        - (d) Assemble Image
        - (e) Transfer Image
        - (f) Finish/Bind Product
    - (3) Equipment and Materials
        - (a) Word Processors
        - (b) Scanners
        - (c) Printers/Plotters
        - (d) Reader/Printers
        - (e) Software
        - (f) Paper
        - (g) Microform Substrates
        - (h) Instant Slide Film
    - (4) Basic Principles
        - (a) Printer/Plotter Operation
        - (b) Computer Operation
        - (c) Message Analysis
        - (d) Design Principles
        - (e) Microform Reproduction
        - (f) Computer Generated Slides
        - (g) Cost Estimation

- (5) Applications
  - (a) Recording of History
  - (b) Education
  - (c) Advertising
  - (d) Decoration
  - (e) Entertainment
  - (f) Identification
  - (g) Other
- (6) Impact
  - (a) Free Press and Democracy
  - (b) Expand Time and Location Awareness
  - (c) Provide Personal and Historical Records
  - (d) Provide Personal Enjoyment
  - (e) Influence the Economy
  - (f) Influence Consumer Choices
  - (g) Potential for Being Abusive/Misleading
  - (h) Provide for Artistic Expression
  - (i) Potential for Much Waste Material
  - (j) Increased Publication Speed
  - (k) Other

D. Acoustical (Audio) Communication Systems

- 1. Hardwired Audio Transmission/Reception Systems
  - a. Hardwired Audio Sub-Systems
    - (1) Telegraph
      - (a) History of Telegraph
      - (b) Encoding/Decoding Sequence
      - (c) Transmitter
      - (d) Receiver
      - (e) Principles of Electrical Circuits
      - (f) Principles of Magnetism
      - (g) Morse Code
    - (2) Telephone
      - (a) History of Telephone
      - (b) Terminals
      - (c) Transmission Links
      - (d) Switching Operations
      - (e) Principles of Circuitry
      - (f) Carbon Granule Transmitter
      - (g) Electromagnetic Receiver
    - (3) Public Address
      - (a) History of Public Address System
      - (b) Microphone
      - (c) Speakers
      - (d) Principles of Circuitry
    - (4) Electrical Warning Devices
      - (a) History of Electric Warning Devices
      - (b) Vehicular Warning Devices
      - (c) Building Warning Devices
      - (d) Other Warning Devices
      - (e) Principles of Circuitry
      - (f) Encoding/Decoding Sequence
    - (5) Modem Machine Interface
      - (a) History of Modem
      - (b) Encoding/Decoding Sequence

        - (6) Other
    - b. Applications
        - (1) Scheduling For Railroads
        - (2) Western Union
        - (3) FTD Florists
        - (4) Military Strategy
        - (5) Business/Personal Correspondence
        - (6) Amplify Sound To Large Groups
        - (7) Other
    - c. Impact
        - (1) Provide Instantaneous Telecommunication
        - (2) Provide Cultural Exchange
        - (3) Influence the Economy
        - (4) Provide Personal Touch
        - (5) Led to Further Inventions
        - (6) Provide a Measure of Security/Safety
        - (7) Other
- 2. Electromagnetic Audio Transmission/Reception Systems
    - a. Electromagnetic Audio Sub-Systems
        - (1) Wireless Telegraph
            - (a) Transmitter
            - (b) Receiver
            - (c) Principles of Radio Wave Transmission
            - (d) Morse Code
        - (2) Radio
            - (a) Transmitter
            - (b) Receiver
            - (c) Principles of Radio Wave Transmission
            - (d) Voice Communication
            - (e) AM-FM Signals
            - (f) CB's/Mobile Phones
        - (4) Sonar
            - (a) Transceiver
            - (b) Principles of Sonar
            - (c) Sound In Water
        - (3) Radar
            - (a) Transceiver
            - (b) Principles of Radar
            - (c) Inaudible Sound
    - b. Electromagnetic Spectrum
    - c. Applications
        - (1) Information/Entertainment System
        - (2) Portable Telephone
        - (3) Warning Device
        - (4) Monitoring Device
        - (5) Medical Diagnostic Aid
        - (6) Other

- d. Impact
    - (1) Provide a Measure of Security/Safety
    - (2) Influence the Economy
    - (3) Provide Entertainment
    - (4) Allows Instantaneous Messages
    - (5) Provide Mass Communication
    - (6) Potential for Being Abusive/Misleading
    - (7) Provide Cultural Exchange
    - (8) Other

3. Audio Storage and Retrieval Systems
    - a. Historical Systems
        - (1) Music Box (Cylinder)
        - (2) Player Piano (Paper Roll)
        - (3) Phonograph (Cylinder)
    - b. Modern Systems
        - (1) Mechanical (Recording Disk)
        - (2) Magnetic (Magnetic Tape)
        - (3) Laser (Compact Disk)
    - c. Encoding and Decoding Used
        - (1) Energy Conversion Methods
            - (a) Motion to Electrical
            - (b) Electrical to Motion
            - (c) Motion to Electrical to Motion
            - (d) Light to Electrical to Motion
            - (e) Motion to Electrical to Light
        - (2) Formatting Methods
            - (a) Monophonic
            - (b) Stereophonic
            - (c) Quadraphonic
    - d. Production Sequence
        - (1) Preparation
            - (a) Script
            - (b) Equipment/Material
            - (c) Personnel
        - (2) Rehearsal
        - (3) Recording
        - (4) Editing
        - (5) Marketing
    - e. Equipment and Materials
        - (1) Mechanical Systems
            - (a) Recording Devices
            - (b) Recording Disks
            - (c) Turn Tables
        - (2) Magnetic Systems
            - (a) Recording Heads
            - (b) Magnetic Tapes
            - (c) Playback Heads
            - (d) Reel-to-Reel
            - (e) Cartridge
            - (f) Cassette
        - (3) Laser Systems
            - (a) Laser Recorders
            - (b) Laser Disks
            - (c) Laser Disk Players

- f. Basic Principles
  - (1) Mechanical Systems
  - (2) Magnetic Systems
  - (3) Laser Systems
  - (4) Monophonic Techniques
  - (5) Stereophonic Techniques
  - (6) Quadraphonic Techniques
- g. Applications
  - (1) Home/School
    - (a) Entertainment (Stereos)
    - (b) Information (Talking Books)
    - (c) Record Keeping (Audio Diaries)
  - (2) Industry/Government
    - (a) Entertainment (Recording Studios)
    - (b) Information (News Reporters)
    - (c) Record Keeping (Cockpit Recorders)
- h. Impact
  - (1) Influence the Economy
  - (2) Personal Enjoyment
  - (3) Informed Public
  - (4) Historical/Personal Record
  - (5) Provide Social/Cultural Exchange
  - (6) Potential for Being Abusive/Misleading

E. Combined Optical/Acoustical (Audio-Visual) Systems
- 1. Television
  - a. Transmission/Reception
    - (1) Frequency Bands
      - (a) Ultra High Frequency (UHF)
      - (b) Very High Frequency (VHF)
    - (2) Network Links
      - (a) Microwave
      - (b) Satellite
      - (c) Closed-Circuit Cable
      - (d) Closed-Circuit Air
  - b. Storage and Retrieval
    - (1) Video Cassette Recorder
    - (2) Laser Video Disk
    - (3) Teletext/Videotext
  - c. Production Sequence
    - (1) Design Audio-Visual Storyboard
    - (2) Audition/Casting
    - (3) Schedule/Produce
    - (4) Prepare Stage/Set
      - (a) Lighting
      - (b) Cameras
      - (c) Sound
      - (d) Props
      - (e) Scenery
      - (f) Special Effects
    - (5) Practice/Rehearse

            (6) Produce the Message
                (a) Publish
                (b) Record
                (c) Develop/Print
                (d) Edit
                (e) Finish
                (f) Process
                (g) Other
            (7) Deliver the Message
            (8) Market the Product
                (a) Promote/Advertise
                (b) Sell
        d. Basic Principles
            (1) Camera Operation
            (2) Lighting
            (3) Sound
            (4) Stage Preparation
            (5) Message Design
            (6) Signal Transmission
                (a) Audio Signal
                (b) Video Signal
            (7) Satellite Relay
            (8) Microwave Relay
            (9) Signal Reception
            (10) Video Recorders
    2. Audio-Visual Projectors
        a. Types of Projectors
            (1) Motion Picture/Film
            (2) Slide/Cassette
            (3) Other
        b. Basic Principles
            (1) Audio Signal
            (2) Video Image
    3. Videophones
        a. Equipment Components
        b. Basic Principles
    4. Applications
        a. Education/Information
        b. Medicine
        c. Industry
        d. Entertainment
        e. Advertisement
        f. Motion Study
        g. Other
    5. Impact
        a. Influence the Economy
        b. Informed Public
        c. Influence Consumer Choice
        d. Potential for Being Abusive/Misleading
        e. Influence Use of Personal Time
        f. Increased Social/Cultural Exchange
        g. Provide Personal Enjoyment
        h. Other

F. Other Communication Systems
- 1. Other Optical (Visual) Systems
  - a. Reflected Light--Three-Dimensional Graphic Symbols/Messages
    - (1) Traffic/Park Signs
    - (2) Billboards/Ads
    - (3) Flags
      - (a) Ship Semaphore
      - (b) Weather
      - (c) Car Racing
      - (d) National Flags
    - (4) Monuments/Memorials
    - (5) Other
  - b. Reflected Light--Non-Graphic Signals
    - (1) Smoke
    - (2) Deaf Sign Language
      - (a) American Sign Language (Ameslan)
      - (b) Signing
    - (3) Hand Signals
      - (a) Sports Officials
      - (b) Highway Driving
      - (c) Construction
    - (4) Body Language
  - c. Light Signals
    - (1) On/Off Signals
      - (a) Lighthouse
      - (b) Airport Runway and Beacon
      - (c) Boats and Aircraft
      - (d) Old North Church
      - (e) Electrical Continuity Tester
    - (2) Electronically Controlled
      - (a) Traffic Lights
      - (b) Programmed Theater Lighting
      - (c) Repeated Scoreboard Messages
    - (3) Human Controlled
      - (a) Scoreboard Scores
      - (b) Pedestrian Controlled Stoplights
      - (c) Vehicular Turn and Back-Up Lights
- 2. Other Acoustical (Audio) Systems
  - a. Musical Instruments
    - (1) Piano
    - (2) Organ
    - (3) Percussion
    - (4) Strings
    - (5) Woodwind and Brass (Air Columns)
  - b. Other Non-Electrical Sound Systems
    - (1) Mechanical Alarm Clock
    - (2) Church Bells
    - (3) Pneumatic Sirens or Horns
    - (4) Drums
    - (5) Teakettle
    - (6) Tap Wall for Studs
    - (7) Railroad Steam Whistle
    - (8) Other

3. Tactile Systems
    a. Texture
        (1) Surface Texture
        (2) Object Shape
        (3) Braille
        (4) Raised Labels
        (5) Baseball Warning Track
        (6) Highway Center Line Bumps or Ruble Strip
        (7) Other
    b. Movement
        (1) Body Tension
        (2) Vibrating Pins (Opticon Scanner)
        (3) Faulty Machinery
        (4) Low Voltage Shock Alert
        (5) Escalator/Elevator
        (6) Water Current
        (7) Other
    c. Temperature
        (1) Radiation of Heat/Cold
        (2) Water Faucets
        (3) Friction of Machines
        (4) Medical Indicator
        (5) Other
    d. Location or Sequence
        (1) Telephone Dial
        (2) Keyboard
        (3) Water Faucets
        (4) Light Switches
        (5) Cash Register Drawer
        (6) Furniture Arrangement
        (7) Money Arrangement (Billfold)
        (8) Clothes Arrangement
        (9) Food Arrangement on Plate
        (10) Other
4. Olfactory/Smell Systems
    a. Smoke
    b. Scratch and Sniff Products
    c. Chemicals
    d. Perfumes
    e. Scented Products
    f. Food Product Discrimination
    g. Medical Indicator
    h. Other
5. Gustatory/Taste Systems
    a. Flavored Products
    b. Medical Indicator
    c. Food Seasoning Discrimination
    d. Edible Food Discrimination
    e. Other

G. Selected Emerging Areas: Communication Technology
- 1. New Concepts/Devices/Services
  - a. Video Systems
    - (1) Word Processor
    - (2) Desktop Publishing
    - (3) Computer Printers (Ink Jet, Laser, Heat Transfer)
    - (4) Closed-Caption Message
  - b. Audio Systems
    - (1) Compact Disk Recorders
    - (2) Pagers/Beepers
    - (3) Teleconference
    - (4) Expanded Telephone Service Options
  - c. Audio-Visual Systems
    - (1) 3-D Imaging
    - (2) Automobile Monitor/Control
    - (3) Stereo Television
    - (4) SAT Television Receiver (Audio Language Translation)
    - (5) Two-Way Cable Television
      - (a) Pay-Per-View
      - (b) Shop At Home
      - (c) Data Base Inquiry
    - (6) Closed-Circuit Television
    - (7) Videophone
    - (8) Centralized Television Viewing
  - d. Integrated Communication Technology Systems
    - (1) Laser
    - (2) Fiber Optics
    - (3) Satellite Dish/Receiver Scrambler/Decoder/Tuner
    - (4) Computer Integrated Manufacturing
    - (5) Self-Repairing Computers
    - (6) Facsimile
- 2. Potential Trends In Communication Technology
  - a. Computerized Medical Diagnositic and Prescription Machines
  - b. Transmission--Analog to Digital Conversion
  - c. Decline in Print Media
  - d. Videoconferencing, Home Banking and Home Shopping
  - e. Mobile Communication Systems
  - f. Computerized Medical Language Translation
  - g. Increased Use of Non-Film Photography
- 3. Current Social/Cultural Issues in Communication Technology
  - a. Copyright Protection/Access to Information
  - b. Freedom of Speech/Censorship
  - c. Monopoly of Ownership/Restricted Information
  - d. Government Regulation/Universal Availability of Service
  - e. Right to Privacy/Freedom of Information

Lesson Title: Overview of Communication Technology

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills involving the curricular interrelationships, the historical aspects, the safety concerns, and the career opportunities in communication technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: communication, optical/visual, graphic, acoustical/audio, broadcasting, audio-visual.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Sketch a model of the components of a communication system. *ITE 2.4, 3.3*
4. State the use of communication technology in materials and processing as well as in energy and power technology. *ITE 3.1, 3.2*
5. Cite examples of scientific principles, mathematical applications, social/cultural interaction, and language arts applications in the communication technology of today. *ITE 2.4, 2.7, 2.9, 2.19*
6. State the unique contribution of each selected technological development in communication toward the technology of that time and toward present day technology. *ITE 2.19*
7. State potential safety hazards in the communication occupations and describe equipment safety guards and personal protective equipment which have been developed to provide safer working conditions in these industries.
8. Follow in all laboratory activities the safety regulations applying in the laboratory. *ITE 2.18*
9. Select from a list of occupations those found in communication and describe the type of work involved in each occupation. *ITE 2.14, 2.15, 2.16, 2.17*
10. Match occupations in communication with the educational/skill level required for that occupation and with the classification level of that occupation. *ITE 2.14, 2.15, 2.16, 2.17*
11. Identify at least one agency which regulates communication and discuss its role and function.

Content Outline	Teacher Plans and Activities

IV. Communication Technology
  A. Overview of Communication Technology
    1. Definitions
      a. Communication
      b. Optical/Visual
      c. Graphic
      d. Acoustical/Audio
      e. Broadcasting
      f. Telecommunication
      g. Audio-Visual
    2. Importance of Communication Technology
    3. Communication Systems Model
    4. Relationship of Other Curricular Areas to Communication Technology
      a. Scientific Principles
      b. Mathematical Applications
      c. Social/Cultural Interaction
      d. Language Arts Applications
    5. Timeline of Communication
      a. Pre-Renaissance
        (1) Egyptians
        (2) Babylonians
        (3) Phoenicians
        (4) Chinese
        (5) Greeks
        (6) Romans
      b. Renaissance
        (1) Integration of Printing Technology Components
          (a) Movable Type
          (b) Lockup System
          (c) Press
          (d) Paper
          (e) Ink
          (f) Usable Alphabet
        (2) Attitude Toward Technological Development
      c. Industrial Revolution
        (1) Control of Electricity
        (2) Linotype
        (3) Telegraph
        (4) Telephone
        (5) Phonograph
        (6) Daguerreotype
        (7) Wireless Telegraph
        (8) Kinetoscope
        (9) Box Camera/Roll Film
        (10) Postal System

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Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook materials related to each concept introduced.	
Participate in a class discussion involving definitions of communication, optical/visual, graphic, acoustical/audio, broadcasting, telecommunication, audio-visual; the importance of communication in other technologies; systems model for communication; and curricular relationships related to communication technology.	
Sketch a systems model for a communication technological system.	
Participate in a small group activity in which one member provides an oral description of a drawing of geometric shapes and the other members of the group sketch their understanding of the description. Compare, analyze and discuss why the sketches may differ.	Texas, Communication Systems Guide, pp. 1-4, 109-109B.
Participate in a class discussion with teachers from other curricular areas investigating possible interrelationships between the development of selected communication devices and the principles included in the sciences, mathematics, social sciences, and language arts curriculums of today.	Fales, Technology: Today and Tomorrow, pp. 100-101.
Participate in a small group to research significant technological developments related to communication technology during a selected period of time: prior to or during the Renaissance, during the Industrial Revolution, during the 20th Century, and during the Space Age. Be prepared to discuss the findings in class.	
Write a research paper of approximately three pages describing a selected significant technological development related to communication and its contribution to the technology of that time and to present day technology. Sketches or photos may be added to further describe the development. These papers may be compiled for a given class, duplicated, published as a booklet, and distributed to the class members.	See Unit I, Lesson 3.
Add to the technology timeline significant technological developments related to communication technology.	Jones, Discovering Technology Communication, Activity Guide, 1986, pp. 7-12; Listar, Technology Activity Guide I, 1988, pp. 73-77.

Content Outline **Teacher Plans and Activities**

- **IV. Communication Technology**
  - **A. Overview of Communication**
    - **5. Timeline of Communication**
      - d. Twentieth Century
        - (1) Radio
        - (2) Television
        - (3) Computer
        - (4) Instant Camera
        - (5) Radar/Sonar
        - (6) Disk/Tape Recorder
      - e. Space Age
        - (1) Transistor
        - (2) Satellite
        - (3) Integrated Circuit
        - (4) Fiber Optics
        - (5) Personal Computer
        - (6) Compact Disk
    - 6. Special Safety Concerns
      - a. Potential Hazards
      - b. Equipment Safety Guards
      - c. Personal Protective Equipment
      - d. Past Records
    - 7. Careers in Communication
      - a. Selected Communication Occupations
        - (1) Commercial Art and Design
          - (a) Designer
          - (b) Layout Artist
          - (c) Art Director
        - (2) Photography
          - (a) Press Photographer
          - (b) Freelance Photographer
          - (c) Commercial Photographer
          - (d) Portrait Photographer
        - (3) Engineering Drafting and Design
          - (a) Designer
          - (b) Drafter
          - (c) Checker
          - (d) CAD Technician

Suggested Student Activities	References/AV/Supplies/Equipment
View a film or video tape related to the significant technological developments in communication.	"Classroom Guide: The EPCOT Center Experience", pp. 2-15, EPCOT Educational Media, 500 S. Buena Vista St., Burbank, CA 91521.
Participate in one of three groups (an eighteenth century group, a nineteenth century group, or a twentieth century group) to reproduce a message using writing materials that a student would have used in that time period. Carefully record the time required to make the reproduction and compare the time and the written message with those from the other two groups.	Harms, Communication Technology Activities, 1988, pp. 4-9; Heiner, People Create Technology. Activity Manual, 1980, pp. 69-70.
Make a collage showing the ways in which people use technology in communicating with one another or research an early communication device, construct a model of it and make a class presentation about the device and the role it has played in the history of communication technology.	Jones, Discovering Technology Communication, 1986, pp. 4-6; 19-22.
Prepare a bulletin board display depicting the postal system as a system of communication.	
Participate in class discussion related to potential safety hazards of communication, equipment safety guards that have been developed, and personal protective equipment available to provide safer working conditions.	
Participate in a class discussion related to career opportunities in communication.	
Compile a list of occupations related to communication. Review the differences among professional, technical, skilled, supervisory, sales, and service occupational classifications. Complete a worksheet by selecting the classification level of each occupation and describing the type of work in each occupation.	
Select at least two occupations and research information about the skill and the educational requirements, the long-range potential for employment in that occupation, and working conditions. Participate in a class discussion related to communication occupations.	

Content Outline **Teacher Plans and Activities**

- **IV. Communication Technology**
  - **A. Overview of Communication**
    - **7. Careers in Communication**
      - **a. Selected Communication Occupations**
        - (4) Printing and Publishing
          - (a) Writer
          - (b) Editor
          - (c) Process Camera Photographer
          - (d) Press Operator
          - (e) Typesetter
          - (f) Bindery Worker
        - (5) Advertising
          - (a) Graphic Artist
          - (b) Writer
          - (c) Salesperson
        - (6) Broadcasting
          - (a) Writer
          - (b) Reporter
          - (c) Engineer
          - (d) Disc Jockey
          - (e) Audio Technician
          - (f) Lighting Technician
          - (g) Camera Technician
          - (h) Producer
          - (i) Director
        - (7) Cinematography
          - (a) Set Designer
          - (b) Camera Technician
          - (c) Audio Technician
          - (d) Lighting Technician
          - (e) Writer
          - (f) Director
          - (g) Film Editor
        - (8) Telecommunication
          - (a) Telephone Operator
          - (b) Installation and Repair Specialist
          - (c) Line Construction and Maintenance Workers
          - (d) Central Office Installers
    - 8. Regulation of Communication
      - a. Federal Communication Commission
      - b. Federal Trade Commission
      - c. American National Standards Institute
      - d. National Association of Broadcasters

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to regulation of communication activities.	
Participate in one of four groups to complete research related to one of the four regulatory agencies listed in the outline, discuss the types of activities regulated by that agency and report to the class a summary of the findings.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psycho-motor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 16-32, 229-231, 237-239, 253.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 24-65, 88-92, 100-101.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 257-267, 285-287, 290-311.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 113-119, 185-190, 225-229.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 124-135, 141-161, 170-197, 205.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 166-203.
Heiner, et al., People Create Technology, Davis, 1980, pp. 31-36, 61-71, 80, 95-99,169-180.
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Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 193-207, 227-232, 236-238.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 193-212.
Williams, et al., Technology At Work, South-Western, 1987, pp. 265-291.

Selected Readings On Communication

A Timetable of Technology, Hearst Books, 1982.
DuVall, et al.,Getting The Message: The Technology of Communication, Davis, 1981.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 8-32, , 38-40, 116-117, 190-191, 258-259, 266-267.
Kranzberg, et al., Technology in Western Civilization, Volumes I & II, Oxford University Press, 1967.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 5-21, 37, 39-56, 190-192, 256.
Snelling, Robert O. Sr. and Anne M. Snelling, Jobs: What They Are: Where They Are, Simon and Schuster, 1985.
Strandh, A History of the Machine, A & W Publishers, Inc., N. Y., 1979.
U.S. Department of Labor, Dictionary of Occupational Titles, U.S. Government Printing Office.
U.S. Department of Labor, Occupational Outlook Handbook, U.S. Government Printing Office.

Lesson Title: Elements Of The Communication Process

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to message design, message transmission and reception, and the impacts of the communication process.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: communication technology, script, storyboard, feedback, interference, redundancy.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Recognize that in order for a message to be effective, the audience and the purpose of the message must be defined.
4. Recognize that there is a positive correlation between the level of technology and the machine processes used to supplement human communication.
5. List or select from a list at least four purposes of communication. *ITE 3.1, 3.2*
6. List the five W's used for message analysis.
7. Distinguish among: thumbnail sketch, rough sketch, and comprehensive drawing. *ITE 3.4*
8. Write a script for an audio presentation, prepare the drawings for a visual presentation, and/or prepare a storyboard for an audio/visual presentation.
9. Encode, transmit, receive, and decode messages using at least two types of codes.
10. Recognize that without the aid of machines humans only receive messages within the visible light and the audible sound sections of the electromagnetic spectrum.
11. Transmit messages through solid, liquid, and/or atmospheric mediums.
12. State examples of how each of the human senses may be used to communicate.
13. Recognize that for many humans most of communication involves the sense of sight.
14. For two communication devices sketch or arrange in proper sequence the components of the communication system model and describe what is included in each component. *ITE 3.3 , 3.4*
15. State examples of interference, feedback, and redundancy in the communication process.
16. State examples of the impact of good and poor communication at the personal, community, national, or international level. *ITE 2.8*

IV. Communication Technology
  - B. Elements of the Communication Process
    - 1. Pre-Processing
      - a. Message Analysis and Design
        - (1) Who/What Will Send/ Receive the Message?
          - (a) Human-to-Human
          - (b) Human-to-Machine
          - (c) Machine-to-Human
          - (d) Machine-to-Machine
        - (2) What Is the Message?
        - (3) Why Is the Message Needed?
          - (a) To Inform
          - (b) To Instruct
          - (c) To Persuade
          - (d) To Entertain
          - (e) To Control Machines and Tools
        - (4) Where Will the Message Be Transmitted/Received?
          - (a) Short Range (Direct)
          - (b) Intermediate Range (Amplification)
          - (c) Long Range (Telecommunication)
        - (5) When Will the Message Be Transmitted/Received?
          - (a) Short Term (Immediate)
          - (b) Long Term (Storage and Retrieval)
      - b. Message Creation
        - (1) Write Script (Audio)
        - (2) Sketches(Visual)
          - (a) Thumbnail
          - (b) Rough
          - (c) Comprehensive
        - (3) Design Principles (Visual)
          - (a) Balance
          - (b) Proportion
          - (c) Harmony
          - (d) Contrast
          - (e) Rhythm
          - (f) Unity
        - (4) Storyboarding (Audio/Visual)

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in class discussion related to the definition of communication technology, script, storyboard, feedback, interference, redundancy; the need for analysis of audience and identification of the purpose of a message; the five W's of message analysis; the purposes of communication; and the human-machine combinations used in communication.	
Complete a worksheet related to message analysis (five W's) in which several hypothetical situations are described. The given situations should include messages, each with a different purpose and intended audience, such as the U.S. President informing the nation of a recent international development, a political candidate defending his/her program to a vested interest audience, the school principal announcing an all-school-assembly, etc. Students can discuss their analysis in small groups.	Indiana, Graphic Communication Systems, 1987, pp. 23-33; Illinois, Communication Technology Curriculum Guide, p. 14.
Participate in class discussion related to script writing, sketching, and storyboarding of messages.	
Begin writing a script for an audio presentation, preparing the drawings for a visual presentation, or preparing a storyboard for an audio/visual presentation to be completed in a later lesson.	Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, pp, ETE-111-B, ETE-115-B.

Content Outline **Teacher Plans and Activities**

IV. Communication Technology
  B. Elements of the Communication Process
    2. Processing
      a. Message Encoding
        (1) Symbols or Signals As Codes
        (2) Coding Source
          (a) Human
          (b) Machine
        (3) Type of Code
          (a) Light (Lights, Objects, Body Action, Lines, Alphabets, Tones, Colors)
          (b) Sound (Musical Tones, Spoken Language)
          (c) Electrical
          (d) Electromagnetic
          (e) Combination
          (f) Other
        (4) Must Match Receiver's Code
      b. Message Transmission
        (1) Electromagnetic Spectrum Relationship
        (2) Medium(s) Used
          (a) Solid
          (b) Fluid
          (c) Atmosphere
          (d) Space
      c. Message Reception
        (1) Direct Sensory Perception
          (a) Sight
          (b) Hearing
          (c) Touch
          (d) Taste
          (e) Smell
        (2) Extra Sensory Perception
        (3) Indirect Retrieval
      d. Message Decoding
        (1) Type of Code
        (2) Decoding Source
          (a) Human
          (b) Machine
      e. Message Storage and Retrieval

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in class discussion related to a general model of the communication process, types of symbols and signals used as codes, the electromagnetic spectrum, mediums for message transmission, human sensory perception, types of interference, feedback and redundancy.	
Sketch the components of a communication model or arrange the components of the model in proper sequence.	
Bring to class examples of common symbols and signs (look at road maps, street signs, park signs, newspapers, etc.). Display them on a bulletin board or copy them on an overhead transparency and participate in class discussion regarding the meaning of each symbol. Discuss the significance of the universality of symbols and signs.	Illinois, Communication Technology Curriculum Guide, pp. 14.
View a film or video tape on the electromagnetic spectrum and discuss the portions of the spectrum which can be interpreted by human senses and which requires assistance of machine technology.	Illinois, Communication Technology Curriculum Guide, p. 14; Heiner, People Create Technology, Teacher's Guide, 1980 p. 49.
Experiment with the transmission and reception of messages through solid, liquid, and atmospheric mediums.	
Participate in a small group activity or play a game like Charades in which a saying or a phrase must be communicated without the use of written or spoken words.	
Participate in a small group activity involving the encoding, transmitting, receiving and decoding of messages by a variety of codes, such as using a flashlight or tapping device to send Morse Code; using pictographic sentences; using a cryptograph with numerals, letters, or other symbols; using a verbal description to draw a simple geometric design; using Braille, Ameslan or signing code; using flags or drums; etc. Follow-up with a discussion of examples of interference which occurred within the small groups.	Harms, Communication Technology Activities, pp. 10-14; Heiner, People Create Technology Activity Manual, pp. 67-68; Todd, Understanding and Using Technology, pp. 57-59; Hauenstein, The World of Communications Visual Media, Activity Manual, pp. 1-2.

Content Outline **Teacher Plans and Activities**

IV. Communication Technology
  B. Elements of the Communication Process
    2. Processing
      f. Interference
        (1) Natural (Mechanical)
          (a) Noise
          (b) Distortion
          (c) Disruption
        (2) Man-Made (Psychological, Semantic)
          (a) Noise
          (b) Distortion
          (c) Disruption
    3. Post-Processing
      a. Feedback
        (1) Direct
        (2) Indirect
          (a) Short Term (Reactions)
          (b) Long Term (Activities)
      b. Redundancy
      c. Impact
        (1) Personal Level
        (2) Community Level
        (3) National Level
        (4) International Level

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in groups of at least six members to play "Gossip". A sender creates a message of at least ten words and whispers the message to another member of the group. Each member in turn passes the message to another until all have received the message. The sender may write the original message on the chalkboard and the final receiver may write the final message. The two messages are compared and analyzed as to the interference which may have caused the differences.	
Participate in class discussion on the impacts of good and poor communication at the personal, community, national or international level.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 229, 252.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 24-29, 36-39.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 561-567.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 123-135, 169-184.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 165-176, 179-181, 190.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 194-203.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 193-213.

Selected Readings On Communication

DuVall, et al., Getting The Message: The Technology of Communication, Davis, 1981, pp. 1-15, 28-44, 47-71, 73-84.
Hauenstein, et al., The World of Communications: Visual Media, Teacher's Guide, McKnight, 1974, pp. 32-68.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 17-23.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 22-38.

Revision Notes:

Lesson Title: Alphanumeric and Technical Drawing Symbols/Messages

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to alphabets, numbers, and technical drawings as graphic images including sub-systems, production sequence, equipment and materials, basic principles, applications, and impacts.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: graphic, pictograph, alphabets, numerals, technical drawing, ANSI, pictorial, orthographic, schematic, perspective, isometric.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Match from a list the writing instrument used in an early civilization with the material on which the message was written and describe how the available materials of a civilization influenced the forms of the symbols used by that civilization.
4. Arrange in the proper sequence the production steps used in technical drawing. *ITE 3.3*
5. Match from a list line codes with types of lines used in technical drawing.
6. Name and arrange in proper relationship the principal views of orthographic projection.
7. Sketch on graph paper the necessary orthographic and pictorial views of selected objects. *ITE 3.4, 3.6, 3.16, 3.17*
8. Measure length in inches accurately to 1/16th in. and in metrics accurately to one mm.
9. Draw with a T-square, triangles and a scale, with a drafting machine and/or with a computer the necessary orthographic and pictorial views of selected objects. *ITE 2.18, 3.6, 3.7, 3.14, 3.16, 3.17, 3.21*
10. Using ANSI standards, form letters and numerals to provide information on a technical drawing. *ITE 3.5*
11. Read the dimensions and notes from a technical drawing of a selected product. *ITE 3.8*
12. Render a pictorial drawing. *ITE 3.16, 3.17*
13. Make a diazo print of an instrument drawing completed on vellum or film. *ITE 3.10*
14. State three applications each of pictorial, orthographic, and schematic drawings. *ITE 3.1*
15. State at least one positive and one negative impact of technical drawing. *ITE 2.8*

Content Outline **Teacher Plans and Activities**

- IV. Communication Technology
  - C. Optical (Visual) Communication Systems
    - 1. Reflected Light--Graphic Symbols
      - a. Pictographs
      - b. Alphanumeric Symbols/Messages
        - (1) Alphabets
        - (2) Numerals
          - (a) Decimal
          - (b) Quinary
          - (c) Binary
          - (d) Duodecimal
        - (3) Equipment and Materials
          - (a) Quill/Brush and Papyrus
          - (b) Chisel and Stone
          - (c) Stylus and Clay
          - (d) Pencil/Ink and Paper
          - (e) Moveable Type
          - (f) Typewriter
          - (g) Abacus
          - (h) Slide Rule
          - (i) Computer
        - (4) Impacts
          - (a) Extend Communication
          - (b) Stimulate Trade
          - (c) Allow Record Keeping
          - (d) Provide Personal Enjoyment
          - (e) Encourage Cultural Exchange
          - (f) Broad Based Standardization
      - c. Technical Drawing Symbols/ Messages
        - (1) Drawing Sub-Systems
          - (a) Pictorial
          - (b) Orthographic
          - (c) Schematic
        - (2) Production Sequence
          - (a) Plan Layout and Content
          - (b) Make Original Drawing
          - (c) Check Accuracy
          - (d) Make Copies
          - (e) Fasten or Mount Copies
          - (f) Store Original

Content Outline **Teacher Plans and Activities**

- **IV. Communication Technology**
  - **C. Optical (Visual) Communication Systems**
    - **1. Reflected Light--Graphic Symbols**
      - e. Printed Graphic Reproduction
        - (1) Image Transfer Sub-Systems
          - (a) Relief Printing
          - (b) Planographic Printing
          - (c) Intaglio Printing
          - (d) Stencil Printing
          - (e) Ink Jet Printing
          - (f) Electrostatic Copying
          - (g) Diazo Copying
          - (h) Spirit Duplicating
          - (i) Stencil Duplicating
          - (j) Facsimile Transmission
        - (2) Production Sequence
          - (a) Perform Message Analysis
          - (b) Create Design
          - (c) Generate Image
          - (d) Assemble Image
          - (e) Convert Image
          - (f) Prepare Image Carrier
          - (g) Transfer Image
          - (h) Finish/Bind Product

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of graphic, pictograph, alphabets, numerals, technical drawing, ANSI, pictorial, orthographic, schematic, perspective, isometric; pictographic and alphanumeric graphic symbols; equipment and materials used to write early graphic symbols; and their impacts on society.	
Research and write a one or two page paper related to the writing materials, equipment and symbols used by an early civilization. Discuss findings with class members.	
Create a bulletin board display on pictographic and alphanumeric symbols, equipment and materials from early civilizations.	
Participate in class activity using past and present writing methods.	Harms, Communication Technology Activities, pp. 4-9; Heiner, People Create Technology, Activity Manual, pp. 69-70.
Design a series of national or international symbol signs related to a specific topic, such as Olympics, travel, parks, zoo, shopping mall, hospitals, schools, grocery store, maps, etc.	Jones, Discovering Technology Communication, Activity Guide, pp. 27-30; Hacker, Living With Technology, pp. 136-137.
Participate in a class discussion related to the types of technical drawing sub-systems, the production sequence, and the basic purposes of technical drawing.	Henke-Konopasek, Exploring Communications, Student Manual, pp. 21-24.
Prepare a bulletin board display showing examples of various technical drawings and/or the production sequence for technical drawing.	
Review principles of measuring in inches and millimeters and complete additional measuring worksheets as needed.	Listar, Technology Activity Guide I, pp. 7-11.

Content Outline	Teacher Plans and Activities

- **IV. Communication Technology**
  - **C. Optical (Visual) Communication Systems**
    - **1. Reflected Light--Graphic Symbols**
      - **c. Technical Drawing Symbols/ Messages**
        - (3) Basic Purposes
          - (a) Show Shape
          - (b) Show Size
          - (c) Show Relationships
          - (d) Show Characteristics
        - (4) Equipment and Materials
          - (a) Pencils
          - (b) Pen and Ink
          - (c) Graph Paper
          - (d) Drafting Vellum
          - (e) Drafting Film
          - (f) T-Squares and Triangles
          - (h) Scales
          - (i) Templates
          - (j) Drafting Machines
          - (k) Diazo Printer
          - (l) Computer/Tablet/ Plotter
          - (m) Other
        - (5) Basic Principles
          - (a) Sketching
          - (b) Instrument Drawing
          - (c) Computer Aided Drawing/CAD
          - (d) Linear Measurement
          - (e) Line Weights and Codes
          - (f) Orthographic Projection
          - (g) Pictorial
          - (h) Lettering
          - (i) Dimensioning
          - (j) Rendering
          - (k) ANSI Standards

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Suggested Student Activities	References/AV/Supplies/Equipment
Complete a worksheet identifying the name and purpose of standard drafting equipment and materials.	Listar, Technology Activity Guide I, p. 23, Gallo, Production Technology, Student Guide, pp. 17.
Participate in a class demonstration related to sketching techniques, drawing with a T-square and triangles, drawing with a drafting machine, and drawing with a computer.	
Participate in a class demonstration related to the use of: scale, compass, templates, dividers, eraser, pencil, pencil sharpener, pencil pointer, erasing shield, protractor, and vellum.	
Sketch a practice sheet on graph paper using vertical, inclined, and horizontal lines as well as circles and arcs.	Listar, Technology Activity Guide I, pp. 13-19.
Enlarge a specified two-dimensional design by using the "enlarging by squares" technique.	Groneman, General Industrial Education and Technology, 1986, p.176-177; Texas, Communication Systems Guide, pp. 7A-7B.
Participate in a class discussion related to line weights and codes used in drafting as well as projection planes, principal views, space dimensions, view arrangement, and view selection related to orthographic drawings.	
Complete worksheet sketches related to completion of orthographic views, drawing a third view when two are given, and drawing orthographic views from pictorial views, including objects which have hidden features and circular objects which require center lines.	Lindbeck, General Industry and Technology, 1986, pp. 75; Kirkpatrick, Basic Industrial Drafting Skills, 1982, pp. 140-152.
Participate in a class discussion related to sketching and lettering.	
Complete lettering practice worksheets including all letters and numerals as well as paragraph composition.	Lindbeck, General Industry and Technology, 1986, pp. 85; Listar, Technology Activity Guide I, 1987, pp. 25-27.
Complete an instrument drawing of orthographic views needed to describe a specified object using T-square and triangles and/or drafting machine.	Listar, Technology Activity Guide 1, p. 29-31,41; Groneman, General Industrial Education and Technology, p. 177; Kirkpatrick, Basic Industrial Drafting Skills, p. 181-183.
Complete an instrument drawing of orthographic views needed to describe a specified object using computer software.	Hacker, Living With Technology, p. 164-165; Fales, Technology Today and Tomorrow, p. 115 116; Utah, Industrial Arts-Agriculture, pp. Computer Aided Drafting.

Content Outline | **Teacher Plans and Activities**

- **IV. Communication Technology**
  - **C. Optical (Visual) Communication Systems**
    - **1. Reflected Light--Graphic Symbols**
      - **c. Technical Drawing Symbols/Messages**
        - (6) Applications
          - (a) Record Product and Structural Design
          - (b) Convey Design Ideas
          - (c) Graph Data
          - (d) Map Geographical and Political Areas
          - (e) Show Electrical Components
          - (f) Chart A Musical Score
          - (g) Diagram Athletic Plays
          - (h) Diagram Computer Flow Charts
          - (i) Identify Product Parts/Assembly/Repair
          - (j) Other
        - (7) Impact
          - (a) Communication in Manufacturing and Construction
          - (b) Standardization of Parts
          - (c) Consumer Maintenance and Repair
          - (d) Influence the Economy
          - (e) Provide Military Weapon
          - (f) Provide Historical Records
          - (g) Provide Artistic Expression
          - (h) Other

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to pictorial drawings.	
Complete worksheet sketches of isometric drawings from orthographic views.	Listar, Technology Activity Guide I pp. 33-39; Kirkpatrick, Basic Industrial Drafting Skills, pp. 263-266; Groneman, General Industrial Education and Technology, pp. 178-179.
Using instruments, complete an isometric drawing depicting a specified object.	
Participate in a class discussion related to rendering a drawing.	Illinois, Introducing The Exploration Series, pp. 107-118.
Using a soft pencil, render a pictorial drawing.	
Participate in a class discussion related to reading dimensions from a drawing.	
Complete a worksheet related to reading dimensions and notes from drawings.	
Reproduce a diazo copy of an instrument drawing completed on vellum.	
Participate in a class discussion related to presenting data by graphing.	
Sketch on graph paper a bar graph and/or a line graph depicting appropriate data.	Illinois, Communication Technology Curriculum Guide, p. 21; Texas, Communication Systems Guide, pp. 20-22; Jones, Discovering Technology: Communication, Activity Guide, pp. 113-116.
Using instruments, construct a pie graph depicting appropriate data.	
Participate in a class discussion related to the applications of technical drawing and the impact of technical drawing on our society.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 83-86, 102-105, 115-116.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 95-97, 259-279
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 120-180.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 140-146.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 174-175.
Heiner, et al., People Create Technology, Davis, 1980, pp. 95-98, 169-172.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 19-27, 52-57, 63-96.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 197-203, 319-335, 389-392.

Selected Readings On Communication

DuVall, et al.,Getting The Message: The Technology of Communication, Davis, 1981, pp. 101-105.
Feirer, et al., Production Technology, 1986, pp. 47-83.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 33-113.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 57-111.

Selected Readings On Technical Drawing

Earle, James H., Engineering Design Graphics, 5th Edition, Addison-Wesley Publishing Company, 1987.
Eide, Arvid, et al., Engineering Graphics Fundamentals, McGraw-Hill, 1985.
French, Thomas E., et al., Graphic Science and Design, 4th Edition, McGraw-Hill, 1984.
Kirkpatrick, J. Michael, Basic Industrial Drafting Skills, Wadsworth, Inc., 1982.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp, ETE-88-B to ETE-121-B.

Lesson Title: Continuous Tone Photographic Symbols/Messages

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to continuous tone photography as graphic images, including the sub-systems, production sequence, equipment and materials, basic principles, applications, and impacts.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: exposure, depth of field, aperture, F-stop, shutter, pixel, developer, stop bath, fixer, panchromatic, emulsion, antihalation layer, latent image
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Identify the basic parts of a camera and describe the purpose of each. *ITE 3.11*
4. Place in the proper order the production sequence used in photography.
5. List or select from a list the four variables related to exposure control and tell how each may be adjusted to coordinate with the others. *ITE 2.19, 3.11*
6. Describe the relationship between reflected light from the subject and the image on a negative. *ITE 2.19*
7. Sketch and label the layers of film and describe the purpose of each layer. *ITE 2.19*
8. List or select from a list five principles of photographic composition and describe the meaning of each. *ITE 3.13*
9. Apply principles of photographic composition when exposing a roll of film. *ITE 3.13, 3.16*
10. Load film into camera, correctly expose film, and remove film from camera. *ITE 3.16*
11. Sketch the process sequence used in processing photographic film and in processing photographic prints and describe the differences between the two sequences including the chemicals used and the time required for each step. *ITE 2.19*
12. Develop a roll of film following proper safety procedures for handling chemicals. *ITE 3.12*
13. Expose and develop a contact print and a projection print using proper safety procedures. *ITE 2.18, 2.19, 3.12, 3.16*
14. Mount a photographic print for display. *ITE 3.12 , 3.16, 3.21*
15. State four applications of the use of photography. *ITE 3.1*
16. State at least one positive and one negative impact of photography on our society. *ITE 2.8*

Content Outline **Teacher Plans and Activities**

- **IV. Communication Technology**
  - **C. Optical (Visual) Communication Systems**
    - **1. Reflected Light--Graphic Symbols**
      - d. Continuous Tone Photographic Symbols/Messages
        - (1) Photographic Sub-Systems
          - (a) Black & White Negative
          - (b) Color Negative
          - (c) Color Transparency
          - (d) Motion
          - (e) Instant
          - (f) Photo-Video Imaging
          - (g) Holography
          - (h) Radiography/X-Ray
          - (i) Thermography/ Infrared
        - (2) Production Sequence
          - (a) Image Composition
          - (b) Image Exposure
          - (c) Image Conversion
          - (d) Image Reproduction
          - (e) Image Presentation
        - (3) Equipment and Materials
          - (a) Cameras
          - (b) Lenses and Filters
          - (c) Lights and Meters
          - (d) Enlargers and Contact Printers
          - (e) Film Processors
          - (f) Film
          - (g) Processing Chemicals
          - (h) Print Paper
          - (i) Other
        - (4) Basic Principles
          - (a) Composition
          - (b) Camera Operation
          - (c) Exposure Control
          - (d) Film Composition
          - (e) Filter Selection
          - (f) Chemical Processing
          - (g) Holography
          - (h) Radiography and Thermography

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of exposure, depth of field, aperture, F-stop, shutter, pixel, developer, stop bath, fixer, panchromatic, emulsion, antihalation layer, latent image; sub-systems of photography and the production sequence used in photographic systems.	
Develop a bulletin board display showing the various photographic sub-systems and/ or showing the production sequence used in photography.	Illinois, Communication Technology Curriculum Guide, pp. 42; Utah, Communication Technology Course Guide, pp. 50.
Plan, expose and develop a photogram.	Jones, Discovering Technology Communication, Activity Guide, pp. 81-84; Bame, Exploring Technology, Activity Manual, pp. 144-147; Hacker, Living With Technology, pp.166-167.
Participate in an illustrated presentation related to types of cameras, basic parts of a camera, and the purpose of the camera parts. Examine and identify the different kinds of cameras available to the students in the class.	Listar, Technology Activity Guide 1, pp. 65-67.
Make a pinhole camera and use it to expose film.	Texas, Communication Systems Guide, pp. 70-72; Bame, Exploring Technology, Activity Manual, pp. 137-140; Jones, Discovering Technology Communication, Activity Manual, pp. 71-80.
Participate in a class demonstration showing the variables related to exposure control and the camera adjustments available to coordinate these variables.	
View film showing the relationship between reflected light from the subject and the image on a photographic negative; view slide/tape presentation showing the layers of photographic film and the purpose of each layer.	"Photography--How It Works" film from Eastman Kodak Company; "Film--How It Works" slide/tape presentation from Eastman Kodak Company, Audio/Visual Library Distribution, 343 State Street, Rochester, NY 14650.
View a slide presentation on the principles of photographic composition, study photo prints applying these principles and discuss the application of these principles.	"Beginnings of Photographic Composition" slide/tape presentation from Eastman Kodak Company, Audio/Visual Library Distribution, 343 State Street, Rochester, NY 14650.

Content Outline

IV. Communication Technology

- **C. Optical (Visual) Communication Systems**
  - **1. Reflected Light--Graphic Symbols**
    - **d. Continuous Tone Photographic Symbols/Messages**
      - (5) Applications
        - (a) Recording of History
        - (b) Education
        - (c) Recreation
        - (d) Advertising
        - (e) Decoration
        - (f) Entertainment
        - (g) Other
      - (6) Impact
        - (a) Expand Time, Location and Size Awareness
        - (b) Provide Personal and Historical Records
        - (c) Provide Personal Enjoyment
        - (d) Influence Economy
        - (e) Influence Consumer Choices
        - (f) Potential for Being Abusive/Misleading
        - (g) Provide for Artistic Expression
        - (h) Other

Teacher Plans and Activities

If the school or students in class have adequate cameras, each student may expose his/her film independently. If the supply of cameras is less adequate, students may work in small groups with each student exposing a portion of a roll of film. For classes working on a minimum budget, simple instamatic-type cameras using 35-mm cartridges may be used. These are frequently available at yard sales at very little cost. The necessary black and white film cartridges may require a special order at a local camera department; however, the price for a 12-exposure roll is very reasonable.

It may be desirable that a general subject be assigned for the photographic assignments. Such assignment would allow for a general display containing the finished prints of each student related to a subject..

Suggested Student Activities	References/AV/Supplies/Equipment
View demonstrations on how to load film into a camera, how to correctly expose film, how to handle a camera and how to remove film from a camera.	Heiner, People Create Technology, p. 77-78; Indiana, Industrial Technology Education Curriculum, Graphic Communication Systems, p. 63; Jones, Discovering Communication Technology, Activity Manual, pp. 60-70.
Expose a roll of black and white photographic film applying one or more principles of photographic composition.	Texas, Communication Systems Guide, pp. 73-75.
View a demonstration on processing black and white film noting safety precautions required in handling chemicals.	
View slide/tape presentation "Processing Black and White Film"; sketch the process sequence used identifying the purpose, the chemicals used and the time required for each step.	"Processing Black and White Film" slide/tape presentation from Eastman Kodak Company, Audio/Visual Library Distribution, 343 State Street, Rochester, NY 14650.
Develop a roll of black and white film following demonstrated proper safety procedures.	Texas, Communication Systems Guide, pp. 78-81; Listar, Technology Activity Guide 1, 1987, pp. 69.
View a demonstration on exposing and developing a contact print following proper safety procedures.	Texas, Communication Systems Guide, pp. 85.
Expose and develop a contact print using proper safety procedures.	Texas, Communication Systems Guide, pp. 85.
View a demonstration on exposing and developing a projection print following proper safety procedures.	Texas, Communication Systems Guide, pp. 82-86; Listar, Technology Activity Guide 1, 1987, pp. 71-72.
Expose and develop a projection print using proper safety procedures.	
Sketch the process sequence used in developing photographic prints including the chemicals used, the purpose of each chemical and the time required for each step. Compare this sequence with the sequence used in developing film.	Heiner, People Create Technology Activity Manual, pp. 93-94.
View a demonstration on preparing photographic prints for display.	
Mount photographic print for public display.	Texas, Communication Systems Guide, pp. 87-89.
Participate in a class discussion related to the applications of photography and the impact of photography on our society.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 232-234.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 76-81.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, p. 225-258.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 147-149, 166-167.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 176-178.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 203-205, 216.
Williams, et al., Technology At Work, South-Western, 1987, pp. 279-282.

Selected Readings On Communication

DuVall, et al., Getting The Message: The Technology of Communication, Davis, 1981, pp. 117-122, 131-135.
Hauenstein, et al., The World of Communications: Visual Media, Teacher's Guide, McKnight, 1974, pp. 113-116.
Henak-Konopasek, et al., Exploring Communications, Student Manual, Goodheart-Willcox, 1987, pp. 51-54.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 183-232.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 150-160.

Selected Readings On Photography

Dennis, Ervin, Applied Photography, Delmar, 1985, p. 35-54, 76-154, 176-259, 295-308.
Yob, Parry C., Petersen's Photo Equipment You Can Make, Petersen Publishing Company, 1973, 8490 Sunset Blvd., Los Angeles, CA 90069
"Visual Learning Materials Packet", Publication Number: VR-11, Eastman Kodak Company, Educational Markets Services, 343 State Street, Rochester, NY 14650.
"Basic Developing, Printing, Enlarging in Black and White", Publication Number: AJ-2, Eastman Kodak Company, Educational Markets Services, 343 State St., Rochester, NY 14650.
"Enlarging", Publication Number: AG-16, Eastman Kodak Company, Educational Markets Services, 343 State Street, Rochester, NY 14650.
"About Kodak Photographic Film", Publication Number: CR-7, Eastman Kodak Company, Educational Markets Services, 343 State Street, Rochester, NY 14650.

Lesson Title: Printed and Computer Generated Graphic Reproduction

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to quantity reproduction of graphic materials using impact, electrostatic, and computer printing processes, including the sub-systems, production sequence, equipment and materials, basic principles, applications, and impacts.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: orthochromatic, lithography, offset, letterpress, gravure, screen process, clip art, halftone, proofread, pasteup, score, collate.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish among relief, planographic, intaglio, and stencil printing surfaces.
4. Distinguish between electrostatic printing processes and impact printing processes.
5. Distinguish among printing, copying, and duplicating.
6. Arrange in the proper sequence the production steps for reproducing printed images and for reproducing computer images. *ITE 3.19*
7. Describe the purpose and the intended audience for a selected printed message.
8. Design a selected printed product using principles of design, include thumbnail sketches, a rough sketch, and a comprehensive drawing. *ITE 3.13, 3.16, 3.19*
9. Generate the word copy and illustration copy for a selected printed product and assemble the copy in the desired format in a safe manner. *ITE 3.9, 3.16, 3.19*
10. Perform in a safe manner the photographic processes necessary for image conversion for a selected printed product. *ITE 3.16, 3,19, 3.21*
11. Prepare the image carrier and transfer or copy the image for a selected printed product in a safe manner. *ITE 3.10, 3.16, 3.19*
12. Complete in a safe manner the finishing and binding processes necessary for a selected printed product. *ITE 3.16, 3.19, 3.21*
13. Reproduce an image using a computer printer or plotter. *ITE 3.14, 3.15, 3.16, 3.19*
14. State four applications each of printing and of computer graphic reproduction. *ITE 3.1*
15. State at least one positive and one negative impact of printing reproduction and of computer graphic reproduction. *ITE 2.8*

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion defining terms in competency #1; distinguishing among printing, duplicating, and copying; describing electrostatic printing/copying; and distinguishing among the various methods of impact printing.	Film, Graphic Communications--We Use To Call It Printing, E. I. duPont de Nemours Co., Inc., Advertising Section, 1007 Market St., Wilmington, DE 19898.
Bring for a class display examples of printed products using a variety of materials.	Illinois, Communication Technology Curriculum Guide, p. 49; Jones, Discovering Technology Communications, p. 121.
Prepare a bulletin board display showing printing/copying using the various image transfer sub-systems and pointing out the method used to print each of the items displayed; or complete a worksheet identifying the image transfer method used for a selected list of graphic images.	Jones, Discovering Technology Communications, pp. 121; Indiana, Graphic Communication Systems, pp. 18.
Participate in a field trip at the school to observe printing and copying methods available.	
Participate in a class discussion related to the production sequence used in printing.	
Plan a production sequence for a selected printed/copied product. The complexity of the product will be determined by the time and equipment available. If both time and equipment are limited, the product may be assembled as a master and reproduced on a copier; but if a process camera and a press or duplicator are available, a more complex printed product may be completed using offset or screen process printing. Ideas for a selected printed product might include: safety poster, flyers for a school activity or to promote industrial classes, T-shirts with class motto or theme for communication, bumper stickers, novelty items for a special event, a communication technology newsletter, game marking/scoring pad, a calendar, personalized stationery, etc.	Hacker, Living With Technology, pp. 162-163, 208-209; Heiner, People Create Technology, Activity Manual, pp. 71-76; Harms, Communication Technology Activities, pp. 21-25; Texas, Communication Systems Guide, pp. 93-104; Goetsch, Technology and You, pp. 288; Jones, Discovering Technology Communication, Activity Guide, pp. 40-58; Illinois, Communication Technology Curriculum Guide, pp. 49-50; Fales, Technology: Today and Tomorrow, pp. 106-113.
Participate in an illustrated presentation and class discussion related to message analysis, the sketching/drawing sequence required for designing printed products, and methods of generating and assembling word and illustration copy for printed products.	Berryman, Gregg, Notes on Graphic Design and Visual Communication, available through Transtech Systems, Division of Creative Learning Systems, Inc., 9889-E Hibert Street, San Diego, CA 92131.

Content Outline	Teacher Plans and Activities

IV. Communication Technology

- **C. Optical (Visual) Communication Systems**
  - **1. Reflected Light--Graphic Symbols**
    - **e. Printed Graphic Reproduction**
      - (3) Equipment and Materials
        - (a) Process Cameras
        - (b) Presses/ Duplicators
        - (c) Light Tables
        - (d) Word Processors
        - (e) Folders
        - (f) Paper Cutters
        - (g) Fasteners
        - (h) Paper/Substrates
        - (i) Film
        - (j) Ink
        - (k) Chemicals
        - (l) Other
      - (4) Basic Principles
        - (a) Message Analysis
        - (b) Design Principles
        - (c) Image Generation
        - (d) Image Assembly
        - (e) Camera Operation
        - (f) Exposure Control
        - (g) Film Composition
        - (h) Chemical Processing
        - (i) Halftone /Color Separation
        - (j) Image Carrier Preparation
        - (k) Press/Duplicator/ Copier Operation
        - (l) Finishing/Binding Operations
        - (m) Paper and Ink Production
        - (n) Cost Estimation
      - (5) Applications
        - (a) Recording of History
        - (b) Education
        - (c) Advertising
        - (d) Decoration
        - (e) Entertainment
        - (f) Identification
        - (g) Other

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Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to equipment and materials used in printing.	
Prepare a bulletin board display related to printing equipment and materials.	
Complete a worksheet matching pictures of printing equipment and materials with the names of these products.	Indiana, Graphic Communication Systems, pp. 29-31.
Complete worksheet related to audience analysis and product purpose; in one page or less describe the purpose and the intended audience for a selected printed message.	
Collect examples of printed materials (such as, ads in periodicals, greeting cards, cereal boxes, record albums, book covers, pop bottles, etc.) which illustrate design elements and principles and describe how these materials portray the elements and principles.	MAVCC, Exploring Technology Education, pp. ETE-63-B.
Design a printed product to meet the purpose and audience identified and prepare at least six thumbnail sketches, draw a rough sketch of the best one or two choices, and after discussing your work with the instructor, prepare a comprehensive drawing applying the principles of design.	
Observe a demonstration on generating word copy and illustration copy for a printed product.	
Generate the word copy and the illustration copy for a selected printed product. For maximum breadth of experience, the copy should include examples from as many resources as are available.	
Participate in a field trip to an area print shop, newspaper office or in-plant printing department to observe the printing production sequence, methods of image transfer, and safety practices employed. Or view a film or video tape related to publishing a newspaper.	
Observe a demonstration of assembling the copy of a printed product.	
Assemble the copy for a selected printed product in the desired format.	

Content Outline **Teacher Plans and Activities**

- **IV. Communication Technology**
  - **C. Optical(Visual)Communication Systems**
    - **1. Reflected Light--Graphic Symbols**
      - **e. Printed Graphic Reproduction**
        - (6) Impact
          - (a) Free Press and Democracy
          - (b) Expand Time and Location Awareness
          - (c) Provide Personal and Historical Records
          - (d) Provide Personal Enjoyment
          - (e) Influence the Economy
          - (f) Influence Consumer Choices
          - (g) Potential for Being Abusive/Misleading
          - (h) Provide for Artistic Expression
          - (i) Potential for Large Quantities of Waste Material
          - (j) Other
      - f. Computer Generated Graphic Reproduction
        - (1) Graphic Output Sub-Systems
          - (a) Computer Printing/ Desktop Publishing
          - (b) Computer Plotting
          - (c) Computer Generated Slides
          - (d) Microform Storage of Computer Data
        - (2) Production Sequence
          - (a) Perform Message Analysis
          - (b) Create Design
          - (c) Generate Image
          - (d) Assemble Image
          - (e) Transfer Image
          - (f) Finish/Bind Product
        - (3) Equipment and Materials
          - (a) Word Processors
          - (b) Scanners
          - (c) Printers/Plotters
          - (d) Reader/Printers
          - (e) Software
          - (f) Paper
          - (g) Microform Substrates
          - (h) Instant Slide Film

Suggested Student Activities | **References/AV/Supplies/Equipment**

Participate in an illustrated presentation and class discussion related to photographic image conversion using a process camera, including camera operation, exposure control, and chemical processing.

Observe a demonstration of photographic image conversion using a process camera.

Perform the photographic processes for image conversion of a selected printed product.

Participate in an illustrated presentation and class discussion related to preparing the image carrier for a printed product.

Observe a demonstration of preparing the image carrier.

Prepare the image carrier for a selected printed product.

Participate in an illustrated presentation and class discussion related to transferring or copying the image for a printed product.

Observe a demonstration of transferring or copying the image.

Make at least twenty usable copies of a selected printed product.

Participate in an illustrated presentation and class discussion related to finishing and binding a printed product.

Observe a demonstration on finishing and binding a printed product.

Finish and bind a selected printed product.

Participate in a class discussion related to applications of the use of printing reproduction.

Participate in a class discussion related to the positive and negative impacts of printing reproduction on our society.

Content Outline	Teacher Plans and Activities

IV. Communication Technology
  C. Optical(Visual)Communication Systems
    1. Reflected Light--Graphic Symbols
      f. Computer Generated Graphic Reproduction
        (4) Basic Principles
          (a) Printer/Plotter Operation
          (b) Computer Operation
          (c) Message Analysis
          (d) Design Principles
          (e) Microform Reproduction
          (f) Computer Generated Slides
          (g) Cost Estimation
        (5) Applications
          (a) Recording of History
          (b) Education
          (c) Advertising
          (d) Decoration
          (e) Entertainment
          (f) Identification
          (g) Other
        (6) Impact
          (a) Free Press/ Democracy
          (b) Expand Time and Location Awareness
          (c) Provide Personal/ Historical Records
          (d) Provide Personal Enjoyment
          (e) Influence the Economy
          (f) Influence Consumer Choices
          (g) Potential for Being Abusive/Misleading
          (h) Provide for Artistic Expression
          (i) Potential for Much Waste Material
          (j) Increased Publication Speed
          (k) Other

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to graphic output of computer printer or plotter, computer generated slides, and microform storage of computer data.	
Prepare bulletin board display of computer generated graphic images.	
Participate in class discussion related to the production sequence, the equipment and materials, and basic principles of computer generated graphic reproduction.	
Participate in a class discussion related to applications of computer graphic reproduction.	
Participate in a class discussion related to the positive and negative impacts of computer graphic reproduction on our society.	
Participate in a vocabulary game, such as "$20,000 Pyramid", in which clues would lead to identification of the proper term.	Illinois, Communication Technology Curriculum Guide, pp. 50.
View a film or video tape on image transfer, such as "It's A Screen Printed World".	"It's A Screen Printed World", Advance Process Supply Company, 400 North Noble St., Chicago, IL 60622 (VHS--$60 purchase, Rental--$15).

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 234-237.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 66-76, 106-113.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 257-288.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, p. 181-224.
Groneman, et al., General Industrial Education and Technology, Study Guide, McGraw-Hill, 1986, pp. 39-46.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 139-146, 152-163.
Hacker, et al., Technology In Your World, Delmar, 1987, pp.
Heiner, et al., People Create Technology, Davis, 1980, pp. 98-99, 172-174, 180-181.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 95, 100-122, 131-133.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 207-227, 393-395.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 204-211.
Williams, et al., Technology At Work, South-Western, 1987, pp. 273-279.

Selected Readings On Communication

DuVall, et al., Getting The Message: The Technology of Communication, Davis, 1981, pp. 85-117, 130-133.
Eastman Kodak Company, Exploring the World of Graphic Communications, GA-11 Series of 10 booklets, Educational Markets Services, 343 State Street, Rochester, NY 14650.
Hauenstein, et al., The World of Communications: Visual Media, Teacher's Guide, McKnight, 1974, pp. 142-340.
Henke, et al., Exploring Communications, Student Manual, Goodheart-Willcox, 1987, pp. 37-50.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 111-182.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp, 100-122, 131-133.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 54-55, 113-149, 161-169.

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Lesson Title: Hardwired Audio Transmission/Reception Systems

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to the acoustical (audio) transmission and reception systems which use hardwired electrical or fiber optic circuits (such as telegraph, telephone, and public address), including the sub-systems, equipment and materials, basic principles, applications, and impacts.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: diaphragm, electromagnet, coil, transducer, switch, digital, analog.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Explain or draw a working drawing and a pictorial sketch of a Morse telegraph. *ITE 3.3*
4. Assemble and test a Morse telegraph. *ITE 3,16, 3.20, 3.21*
5. Send and receive a message using the completed Morse telegraph. *ITE 3.16, 3.20, 3.21*
6. Trace an assembly drawing or make a freehand sketch of the six parts of a carbon granule transmitter, label and explain how each part works. *ITE 3.3, 3.16, 3.20*
7. Trace an assembly drawing or make a freehand sketch of the five parts of an electromagnetic receiver, label and explain how each part works. *ITE 3.3, 3.16, 3.20*
8. Draw a complete telephone circuit showing the transmitter, receiver, power source and circuit wiring. *ITE 3.3, 3.16, 3.20*
9. Assemble a telephone using a carbon granule transmitter, stereo speaker, insulated copper wire and six-volt battery following proper safety procedures. *ITE 2.18, 3.16, 3.20, 3.21*
10. Identify and describe four common channels used for long distance telephone communication. *ITE 3.20*
11. Write a report describing the invention of an acoustical communication device. *ITE 3.16*
12. Draw a complete public address circuit schematic showing the microphone, speakers, power source, and circuit wiring. *ITE 3.3, 3.16, 3.20*
13. Identify at least five audio warning devices using electrical circuitry. *ITE 3.16, 3.20*
14. Explain the importance of insulated wire in an electromagnet. *ITE 3.16, 3.20*
15. State at least one positive and one negative impact of the telegraph and the telephone. *ITE 2.8*

Content Outline	Teacher Plans and Activities

IV. Communication Technology
  D. Acoustical (Audio) Communication Systems
    1. Hardwired Audio Transmission/Reception Systems
      a. Hardwired Audio Sub-Systems
        (1) Telegraph
          (a) History of Telegraph
          (b) Encoding/Decoding Sequence
          (c) Transmitter
          (d) Receiver
          (e) Principles of Electrical Circuits
          (f) Principles of Magnetism
          (g) Morse Code
        (2) Telephone
          (a) History of Telephone
          (b) Terminals
          (c) Transmission Links
          (d) Switching Operations
          (e) Principles of Circuitry
          (f) Carbon Granule Transmitter
          (g) Electromagnetic Receiver

Suggested Student Activities	References/AV/Supplies/Equipment
Read the assigned textbook material related to each concept introduced.	
Participate in a class discussion related to diaphragm, electromagnet, coil, transducer, switch, digital, analog; the principles of electrical circuits and magnetism as they relate to a telegraph transmitter and receiver.	
Using drafting equipment or by freehand sketching, create a working drawing of the Morse telegraph.	Hacker, Living With Technology, pp. 198-199.
Participate in a class demonstration related to assembling a telegraph transmitter and receiver and wiring a telegraph circuit.	Hacker, Living With Technology, pp. 198-199; Lindbeck, General Industry and Technology, p. 351; Minton, Teaching Technology to Children, p. 400.
Assemble and test a Morse telegraph.	
Participate in a class demonstration related to transmitting a message by telegraph using Morse Code.	
Participate in a class discussion related to the principles of the telephone circuit, transmission links, carbon granule transmitter, and electromagnetic receiver.	
Participate in a demonstration related to assembling a telephone circuit.	
Using tracing paper and drafting equipment or by freehand sketching create an assembly drawing of the carbon granule transmitter.	Compton's Encyclopedia, Volume 20, pp. 56-61; Texas, Communication Systems Guide, pp. 17-19A; Jones, Discovering Technology Communication, pp. 244.
Using tracing paper and drafting equipment or by freehand sketching create an assembly drawing of the electromagnetic receiver	Compton's Encyclopedia, Volume 20, pp. 56-61.
Draw a complete telephone circuit showing the transmitter, power source, channels, and receiver unit.	
Procure discarded carbon granule transmitters and electromagnetic receivers from the local telephone company. Using stereo or discarded radio speakers and a six-volt battery assemble by soldering a telephone circuit.	

Content Outline	Teacher Plans and Activities

IV. Communication Technology
  D. Acoustical (Audio) Communication Systems
    1. Hardwired Audio Transmission/ Reception Systems
      a. Hardwired Audio Sub-Systems
        (3) Public Address
          (a) History of Public Address System
          (b) Microphone
          (c) Speakers
          (d) Principles of Circuitry
        (4) Electrical Warning Devices
          (a) History of Electric Warning Devices
          (b) Vehicular Warning Devices
          (c) Building Warning Devices
          (d) Other Warning Devices
          (e) Principles of Circuitry
          (f) Encoding/Decoding Sequence
        (5) Modem Machine Interface
          (a) History of Modem
          (b) Encoding/Decoding Sequence
        (6) Other
      b. Applications
        (1) Scheduling For Railroads
        (2) Western Union
        (3) FTD Florists
        (4) Military Strategy
        (5) Business/Personal Correspondence
        (6) Amplify Sound To Large Groups
        (7) Other
      c. Impact
        (1) Provide Instantaneous Telecommunication
        (2) Provide Cultural Exchange
        (3) Influence the Economy
        (4) Provide Personal Touch
        (5) Led to Further Inventions
        (6) Provide a Measure of Security/Safety
        (7) Other

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Suggested Student Activities	References/AV/Supplies/Equipment
Construct a fiber optic link for transmitting an audio signal.	Harms, Communication Technology Activities, p. 15-20; Utah, Industrial Arts-Agriculture, p. "Laser/Fiber Optic Communication"; Hacker, Living With Technology, p. 200-201.
Participate in a field trip to a local telephone company to observe the switching equipment being used there.	Hacker, Living With Technology, p. 174.
Write a two- to three-page report related to the invention of the telephone.	
Participate in a class discussion related to the principles of the public address circuit including the microphone and speakers.	
Participate in a class discussion related to principles of circuits for electrical warning devices and examples of their use.	
Participate in a class discussion related to the present applications and impact of the telegraph, telephone, public address, electrical warning devices and modem machine interface.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 238-240.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 50-57.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 290-296.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 556-557.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 198-199.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 179-184.
Heiner, et al., People Create Technology, Davis, 1980, pp. 176-177.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 43-44, 350-352.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 227-229, 400.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 206-212.
Williams, et al., Technology At Work, South-Western, 1987, pp. 268-270.

Selected Readings On Communication

Compton's Encyclopedia, F. E. Compton Co., University of Chicago, 1973, Volume 20, pp. 56-61.
DuVall, et al., Getting The Message: The Technology of Communication, Davis, 1981, pp. 140-178, 183-194.
Encyclopaedia of Science and Technology, Volume 18, McGraw-Hill, 1987, pp. 156-160.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 243-245.
Kahaner, Larry, The Phone Book: The Most Complete Guide to the Changing World of Telephones. Tilden Press, 1983.
O'Connor, Jerome J., The Telephone and How It Works, Putnam, 1971.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 173-177, 197-198, 203.
The World Book Encyclopedia, Volume 19, World Book Inc. 1983, pp. 80-82.

Lesson Title: Electromagnetic Audio Transmission/Reception Systems

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to acoustical (audio) transmission and reception systems which use electromagnetic energy (such as radar, radio, and sonar), including the subsystems, equipment and materials, basic principles, applications and impacts.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: volt, ampere, ohm, Hertz, Henry, Farad.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish between the wireless telegraph and the radio. *ITE 3.16, 3.20*
4. Match each of the following electrical concepts with an electrical unit of measure: electrical push, electric current, electrical resistance, inductance, capacitance, and frequency. *ITE 3.16*
5. Discuss each of the following electrical concepts: radio transmitter, electromagnetic signal, radio receiver, tuning circuit, amplifying circuit, alternating current, direct current, and piezoelectric effect. *ITE 3.16, 3.20*
6. Describe the function of each of the components of a simple radio. *ITE 3.16, 3.20*
7. Draw a simple radio circuit using standard schematic symbols for: antenna, inductor, capacitor, ground, diode, battery, transistor, resistor, and crystal earphone. *ITE 3.20*
8. Distinguish between two types of radio message channels. *ITE 3.16*
9. Construct a simple AM radio and test its capability to receive signals from the local radio station following proper safety procedures. *ITE 2.18, 3.16, 3.20, 3.21*
10. Draw the electromagnetic spectrum and highlight the area used for radio, radar and sonar communication. *ITE 3.20*
11. Distinguish between radar and sonar. *ITE 3.16, 3.20*
12. Using an encyclopedia, write a report related to the development and use of radio, radar or sonar. *ITE 3.16*
13. State two applications each of radio, radar and sonar. *ITE 3.1, 3.20*
14. State at least one positive and one negative impact each of radio, radar and sonar. *ITE 2.8*

Content Outline | **Teacher Plans and Activities**

IV. Communication Technology

D. Acoustical (Audio) Communication Systems

2. Electromagnetic Audio Transmission/Reception Systems
   - a. Electromagnetic Audio Sub-Systems
     - (1) Wireless Telegraph
       - (a) Transmitter
       - (b) Receiver
       - (c) Principles of Radio Wave Transmission
       - (d) Morse Code
     - (2) Radio
       - (a) Transmitter
       - (b) Receiver
       - (c) Principles of Radio Wave Transmission
       - (d) Voice Communication
       - (e) AM-FM Signals
       - (f) CB's/Mobile Phones
     - (3) Sonar
       - (a) Transceiver
       - (b) Principles of Sonar
       - (c) Sound In Water
     - (4) Radar
       - (a) Transceiver
       - (b) Principles of Radar
       - (c) Inaudible Sound
   - b. Electromagnetic Spectrum
   - c. Applications
     - (1) Information/Entertainment System
     - (2) Portable Telephone
     - (3) Warning Device
     - (4) Monitoring Device
     - (5) Medical Diagnostic Aid
     - (6) Other
   - d. Impact
     - (1) Provide a Measure of Security/Safety
     - (2) Influence the Economy
     - (3) Provide Entertainment
     - (4) Allows Instantaneous Messages
     - (5) Provide Mass Communication
     - (6) Potential for Being Abusive/Misleading
     - (7) Provide Cultural Exchange
     - (8) Other

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion about definitions in competency #1; the development of the wireless telegraph and the radio; units of electrical measurement, radio concepts, and electronic schematic symbols.	
View a film or video tape related to the operation of a radio.	
Draw a schematic diagram of a simple radio circuit and select and position the corresponding component parts on the drawing, then construct a simple radio receiver circuit using the schematic drawing as a guide.	Heiner, People Create Technology, Activity Manual,, pp. 65-66; Todd, Understanding and Using Technology, Activity Manual, pp. 145-148; Bame, Exploring Technology, Activity Manual, pp. 149-153.
Draw the electromagnetic spectrum and highlight the radio frequencies.	Hacker, Living With Technology, pp. 182.
Observe and compare as many types of radio equipment as possible. (police, weather, CB, Ham radio, etc.)	Hacker, Living With Technology, pp. 120-121; Radio Shack: Science Fair AM-FM Radio Kit, Catalog Number 28-175; Illinois, Communication Technology Curriculum Guide, pp. 29.
Participate in a field trip to a radio studio or in a guest presentation by an employee of a radio station describing the transmission of a radio program.	
Read a disaster story, such as A Night to Remember: the Sinking of the Titanic (chapter two), and discuss the role of radio in saving lives.	
Complete the audio script for a 30-second radio commercial or a three minute newscast for recording Lesson IV-8 or for live presentation.	
Write a report telling about the development and use of the radio, radar, or sonar.	The World Book Encyclopedia, Volume 16, World Book Inc., Chicago, pp. 78-93.
Participate in a class discussion related to the principles involved in using radar and sonar.	
Create a bulletin board display showing the development and use of the radio, radar, and sonar for communication.	
Participate in a class discussion related to the applications and impacts of the wireless telegraph, radio, radar, and sonar.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 149-153.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 56-57.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 291-300.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 555-558.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 175-179, 182.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 185-188.
Heiner, et al., People Create Technology, Davis, 1980, pp. 176-178.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 350-354.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 227-238.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 145-148.
Williams, et al., Technology At Work, South-Western, 1987, pp. 282-284, 289.

Selected Readings On Communication

Carter, Alden R., Radio--From Marconi To The Space Age, Franklin Watts, 387 Park Avenue South, New York, NY 10016.
DuVall, et al.,Getting The Message: The Technology of Communication, Davis, 1981, pp. 174-177, 189-194.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 234-238, 245.
Lord, Walter. A Night to Remember: The Sinking of the Titanic. Holt, Rinehart and Winston, New York, 1976.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 170-176,182-194.
The World Book Encyclopedia, Volume 16, World Book Inc., Chicago, 1983, pp. 78-93.

Revision Notes:

Lesson Title: Audio Storage and Retrieval Systems

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to audio storage and retrieval systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: recording disk, magnetic tape, compact disk.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List at least two examples of historical audio storage/retrieval sub-systems. *ITE 2.10, 2.11*
4. Distinguish among mechanical, magnetic, and laser recording techniques.
5. Distinguish among monophonic, stereophonic, and quadraphonic recording techniques.
6. Arrange in proper order the production sequence necessary to make a commercial quality audio recording. *ITE 3.16, 3.21*
7. Give two major pieces of equipment or materials each for the mechanical, magnetic, and laser storage/retrieval systems. *ITE 1.1*
8. Operate the record and playback functions of a selected audio storage/retrieval system in a correct and safe manner. *ITE 1.4, 2.18, 3.10, 3.21*
9. List four applications of audio storage/retrieval systems. *ITE 2.1*
10. List one positive and one negative impact of audio storage/retrieval systems.

Content Outline	**Teacher Plans and Activities**

IV. Communication Technology

D. Acoustical (Audio) Communication Systems

3. Audio Storage and Retrieval Systems
   - a. Historical Systems
     - (1) Music Box (Cylinder)
     - (2) Player Piano (Paper Roll)
     - (3) Phonograph (Cylinder)
   - b. Modern Systems
     - (1) Mechanical (Recording Disk)
     - (2) Magnetic (Magnetic Tape)
     - (3) Laser (Compact Disk)
   - c. Encoding and Decoding Used
     - (1) Energy Conversion Methods
       - (a) Motion to Electrical
       - (b) Electrical to Motion
       - (c) Motion to Electrical to Motion
       - (d) Light to Electrical to Motion
       - (e) Motion to Electrical to Light
     - (2) Formatting Methods
       - (a) Monophonic
       - (b) Stereophonic
       - (c) Quadraphonic
   - d. Production Sequence
     - (1) Preparation
       - (a) Script
       - (b) Equipment/Material
       - (c) Personnel
     - (2) Rehearsal
     - (3) Recording
     - (4) Editing
     - (5) Marketing

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to definitions of recording disk, magnetic tape, and compact disk; as well as historical and modern systems of audio storage and retrieval.	
Choose an early audio storage/retrieval device, research the device and construct a model of it.	Jones, Discovering Technology: Communication, Activity Guide, pp. 19.
Participate in a class demonstration showing the recording and playback capabilities of available mechanical, magnetic and laser systems.	Jones, Discovering Technology: Communication, Activity Guide, pp. 86.
Construct a simple record player and experiment with the its design to improve the sound quality.	
Participate in a class discussion related to the formatting methods, production sequence, equipment and materials and basic principles of mechanical, magnetic, and laser storage and retrieval systems.	Indiana, Industrial Technology Education Curriculum, Introduction to Communication Technology, pp. 50.
Create an audio recording of the school's cheerleaders or marching band and reproduce several tapes for marketing the product or create an audio recording describing a given theme or situation for use in Unit IV Lesson 10.	
Participating in a small group develop, produce and record a 30-second radio commercial or a three minute newscast as described in Unit IV Lesson 7.	Jones, Discovering Technology: Communication, Activity Guide, pp. 91, and Hacker, Living With Technology, pp. 210.

Content Outline **Teacher Plans and Activities**

IV. Communication Technology
  D. Acoustical (Audio) Communication Systems
    3. Audio Storage and Retrieval Systems
      e. Equipment and Materials
        (1) Mechanical Systems
          (a) Recording Devices
          (b) Recording Disks
          (c) Turn Tables
        (2) Magnetic Systems
          (a) Recording Heads
          (b) Magnetic Tapes
          (c) Playback Heads
          (d) Reel-to-Reel
          (e) Cartridge
          (f) Cassette
        (3) Laser Systems
          (a) Laser Recorders
          (b) Laser Disks
          (c) Laser Disk Players
      f. Basic Principles
        (1) Mechanical Systems
        (2) Magnetic Systems
        (3) Laser Systems
        (4) Monophonic Techniques
        (5) Stereophonic Techniques
        (6) Quadraphonic Techniques
      g. Applications
        (1) Home/School
          (a) Entertainment (Stereos)
          (b) Information (Talking Books)
          (c) Record Keeping (Audio Diaries)
        (2) Industry Government
          (a) Entertainment (Recording Studios)
          (b) Information (News Reporters)
          (c) Record Keeping (Cockpit Recorders)
      h. Impact
        (1) Influence the Economy
        (2) Personal Enjoyment
        (3) Informed Public
        (4) Historical/Personal Record
        (5) Provide Social/Cultural Exchange
        (6) Potential for Being Abusive/Misleading

Suggested Student Activities	**References/AV/Supplies/Equipment**
Participate in a class discussion related to the applications and impact of audio storage and retrieval systems.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psycho-motor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Hacker, et al., Living With Technology, Delmar, 1988, pp. 189-193.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 184-185.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 42-43.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 234-236.

Selected Readings On Communication

DuVall, et al., Getting The Message: The Technology of Communication, Davis, 1981, pp. 195-200.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 238-243.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 16-17, 47, 216-223.

Revision Notes:

Lesson Title: Audio-Visual Systems

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to the transmission/reception and the storage/ retrieval of audio-visual messages using the television including the sub-systems, production sequence, basic principles, applications and impacts as well as the use of videophones and the retrieval of audio-visual messages using projectors.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: screen resolution, vidicon tube, scanning, video signal, phosphors, cathode ray tube (CRT).
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish between the ultra high frequency (UHF) and very high frequency (VHF) bands. *ITE 3.16*
4. Distinguish among microwave, satellite, closed-circuit cable, and closed-circuit air as network links. *ITE 3.16*
5. Describe at least one advantage and disadvantage of each of the following to the consumer: antenna reception, cable, closed-circuit, satellite. *ITE 2.7, 3.16*
6. Distinguish between a video cassette recorder and a laser video disk. *ITE 3.16*
7. Sketch simple diagrams of a model (input, process, output) of a television system including television camera and receiver set and of a picture telephone system. *ITE 3.3*
8. Place in the proper order the production sequence used for producing and transmitting a television message. *ITE 3.3*
9. List the three basic colors used in color television and describe how these are "mixed" into other colors, tones, and shades. *ITE 3.16 , 3.20*
10. Match names of the basic parts of a television camera with a drawing of the camera and describe the function of each part. *ITE 3.16, 3.20*
11. Match names of the basic parts of a color television set with a drawing of the set and describe the function of each part. *ITE 3.16, 3.20*
12. Write and produce a 30-second television commercial. *ITE 3.13, 3.16, 3.20, 3.21*
13. State three applications each of television systems and A/V projectors. *ITE 3.1, 3,21*
14. State at least two positive and two negative impacts of television on our society. *ITE 2.8*

Content Outline **Teacher Plans and Activities**

- IV. Communication Technology
  - E. Combined Optical/Acoustical (Audio-Visual) Systems
    - 1. Television
      - a. Transmission/Reception
        - (1) Frequency Bands
          - (a) Ultra High Frequency (UHF)
          - (b) Very High Frequency (VHF)
        - (2) Network Links
          - (a) Microwave
          - (b) Satellite
          - (c) Closed-Circuit Cable
          - (d) Closed-Circuit Air
      - b. Storage and Retrieval
        - (1) Video Cassette Recorder
        - (2) Laser Video Disk
        - (3) Teletext/Videotext
      - c. Production Sequence
        - (1) Design Audio-Visual Storyboard
        - (2) Audition/Casting
        - (3) Schedule/Produce
        - (4) Prepare Stage/Set
          - (a) Lighting
          - (b) Cameras
          - (c) Sound
          - (d) Props
          - (e) Scenery
          - (f) Special Effects
        - (5) Practice/Rehearse
        - (6) Produce the Message
          - (a) Publish
          - (b) Record
          - (c) Develop/Print
          - (d) Edit
          - (e) Finish
          - (f) Process
          - (g) Other
        - (7) Deliver the Message
        - (8) Market the Product
          - (a) Promote/Advertise
          - (b) Sell

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to television transmission and reception including frequency bands and network links.	
Participate in a class discussion related to the storage and retrieval of audio-visual messages including the video cassette recorder, laser video disk, teletext/videotext.	
Participate in a class discussion related to definitions in competency #1, the production sequence, basic principles involved in a television production, and the operation of the television camera and receiver set.	
Participate in a class discussion with a guest speaker, such as a television repairman, related to the parts of a television camera and receiver set and how they work. Complete a worksheet related to the parts of a television camera and a receiver set by studying repair and instruction manuals accompanying a discarded but operating camera and receiver set.	Discarded but operating television camera and receiver set. Illinois, Communication Technology Curriculum Guide, pp. 29-30; Jones, Discovering Technology Communication, pp. 248-250.
Develop a bulletin board display about television technology.	
View a film or video tape on television production.	
Participate in a field trip to a television studio, observing the equipment used, the production sequence, the safety factors involved, and the career opportunities; discuss observations with the class.	
Complete one of the following productions: (1) work in small groups to produce a 30-60 second television commercial on a new product; (2) set up and tape a "Phil Donohue" type talk show, perhaps invite a speaker as a guest star; (3) write and tape a news program for the school including all of the standard areas of a typical news story (headline events, sports, weather); (4) produce short educational tapes on safe use of equipment and tools in the laboratory (refer to Unit II Lesson 5). Present a public showing of the productions in the school cafeteria or at an open house.	Illinois, Communication Technology Curriculum Guide, pp. 29; Fales, Technology Today and Tomorrow, pp. 113-115; Utah, Industrial Arts-Agriculture, pp. "Audio Visual Technology"; Bame, Exploring Technology, Activity Manual, pp. 155-158; Hacker, Living With Technology, pp. 210-211; Harms, Communication Technology Activities, pp. 33-40.

Content Outline	Teacher Plans and Activities

- **IV. Communication Technology**
  - **E. Combined Optical/Acoustical (Audio-Visual) Systems**
    - **1. Television**
      - d. Basic Principles
        - (1) Camera Operation
        - (2) Lighting
        - (3) Sound
        - (4) Stage Preparation
        - (5) Message Design
        - (6) Signal Transmission
          - (a) Audio Signal
          - (b) Video Signal
        - (7) Satellite Relay
        - (8) Microwave Relay
        - (9) Signal Reception
        - (10) Video Recorders
    - 2. Audio-Visual Projectors
      - a. Types of Projectors
        - (1) Motion Picture/Film
        - (2) Slide/Cassette
        - (3) Other
      - b. Basic Principles
        - (1) Audio Signal
        - (2) Video Image
    - 3. Videophones
      - a. Equipment Components
      - b. Basic Principles
    - 4. Applications
      - a. Education/ Information
      - b. Medicine
      - c. Industry
      - d. Entertainment
      - e. Advertisement
      - f. Motion Study
      - g. Other
    - 5. Impact
      - a. Influence the Economy
      - b. Informed Public
      - c. Influence Consumer Choice
      - d. Potential for Being Abusive/Misleading
      - e. Influence Use of Personal Time
      - f. Increased Social/ Cultural Exchange
      - g. Provide Personal Enjoyment
      - h. Other

Suggested Student Activities	References/AV/Supplies/Equipment
Construct a simulated communication satellite to demonstrate various channels for sending communication signals.	Todd, Understanding and Using Technology, Activity Manual, pp. 105-107, 115-117; Utah, Industrial Arts-Agriculture, pp. "Satellite Technology"; Hacker, Living With Technology, pp. 200-201, 512-513; Harms, Communication Technology Activities, pp. 26-31.
Research a communication satellite of interest, construct a model of your chosen satellite, and complete an identification tag describing it.	Jones, Discovering Technology Communication, Activity Guide, pp. 147-152.
Participate in a field trip to an area microwave relay station or in a class discussion with a guest worker from a microwave relay station .	
Participate in a class discussion related to audio-visual projectors and videophones.	
Participate in a class demonstration of a film projector and/or slide projector with cassette tape.	
Research the development and operation of a picture telephone and prepare a two-page paper (with a model sketch) describing the findings.	For information: American Telephone and Telegraph, Public Relations Office, 10 S. Canal Street, Chicago, IL 60606.
Participate in a class discussion related to the applications and impact of television and audio-visual projectors.	
Interview someone who watched television during the first years of public broadcasting, securing the initial reaction and opinion of the impact of television on his/her life and report the findings to the class to compare the reactions of the various interviewees.	
Make a list of incidents seen on television or heard on radio that qualify as instantaneous information, such as assassinations, election results, accidents, sporting events, weather bulletins, etc., and compare this with earlier times and other countries, such as election results before 1900, before 1950, and in less developed countries; weather bulletins before 1965; War of 1812, Civil War, World War II, and Vietnam War; assassinations of Presidents Lincoln and Kennedy	Illinois, Communication Technology Curriculum Guide, pp. 28.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 244-246.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 54-65.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 300-305.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 559-567.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 179-181, 192, 195.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 188-189, 195-197.
Heiner, et al., People Create Technology, Davis, 1980, pp. 44-45, 178-180.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 354-355.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 99-100, 221-223.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 136-137, 199-201, 206-207, 212, 345-346.
Williams, et al., Technology At Work, South-Western, 1987, pp. 280-282, 284, 342.

Selected Readings On Communication

DuVall, et al., Getting The Message: The Technology of Communication, Davis, 1981, pp. 127-128, 188-189, 212-214, 286.
Huber, David M. Audio Production Techniques For Video. Howard W. Sams, 1987. (4300 West 62nd Street, Indianapolis, IN 46268)
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 247-268.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 52, 186-187, 192-197, 212, 233-239.

Revision Notes:

Lesson Title: Other Communication Systems

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of communication technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to the transmission and reception of messages transmitted within the human sensory range not covered in previous lessons.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: semaphore, Ameslan , signing, Braille.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List three examples each of three-dimensional graphic symbols/messages, non-graphic visual signals, and light signals for visual communication.
4. Create a coded signal using a code mentioned in this lesson and send a message to another individual. *ITE 3.13, 3.16*
5. Identify and use the hand signals used in bicycle travel. *ITE 3.16*
6. Communicate a specific message using sign language. *ITE 3.16*
7. Give three examples each of musical instruments and non-electrical sounds used in audio communication. *ITE 2.19*
8. Distinguish among tactile, olfactory and gustatory sensory perceptions.
9. Give two examples each of texture, movement, temperature and location/sequence used in tactile communication.
10. Give two examples each of smell and taste communication.
11. Recognize that all of the human senses are normally used in communicating. *ITE 3.3*

Content Outline	Teacher Plans and Activities

- IV. Communication Technology
  - F. Other Communication Systems
    - 1. Other Optical (Visual) Systems
      - a. Reflected Light--Three-Dimensional Graphic Symbols/Messages
        - (1) Traffic/Park Signs
        - (2) Billboards/Ads
        - (3) Flags
          - (a) Ship Semaphore
          - (b) Weather
          - (c) Car Racing
          - (d) National Flags
        - (4) Monuments/Memorials
        - (5) Other
      - b. Reflected Light--Non-Graphic Signals
        - (1) Smoke
        - (2) Deaf Sign Language
          - (a) Ameslan
          - (b) Signing
        - (3) Hand Signals
          - (a) Sports Officials
          - (b) Highway Driving
          - (c) Construction
        - (4) Body Language
      - c. Light Signals
        - (1) On/Off Signals
          - (a) Lighthouse
          - (b) Airport Runway/Beacon
          - (c) Boats and Aircraft
          - (d) Old North Church
          - (e) Electrical Continuity Tester
        - (2) Electronically Controlled
          - (a) Traffic Lights
          - (b) Programmed Theater Lighting
          - (c) Repeated Scoreboard Messages
        - (3) Human Controlled
          - (a) Scoreboard Scores
          - (b) Pedestrian Controlled Stoplights
          - (c) Vehicular Turn and Back-Up Lights

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Research a topic of interest related to one of the communication systems described in this lesson and write a two or three page report and be ready to include your findings in the related class discussion.	
Participate in a class discussion related to the definitions: semaphore, Ameslan, signing, Braille; three-dimensional graphic symbols and non-graphic symbols which use reflected light.	
Develop three-dimensional hallway signs which direct the traffic flow.	Illinois, Communication Technology Curriculum Guide, pp. 57.
In small groups develop a three-dimensional billboard for a real or fictitious advertising campaign for a company, organization, club, or individual.	Illinois, Communication Technology Curriculum Guide, pp. 57.
In small groups construct signalling flags and send a message between class members.	Heiner, People Create Technology, pp. 67-68.
Work in small groups to learn how to "sign" and/or write and read in Braille a designated phrase, such as "working with technology", your name, school slogan, etc.	Harms, Communication Technology Activities, pp. 10-13.
Participate in a class demonstration related to hand signals used in bicycle travel.	
Participate in a class discussion related to light signals.	
Participate in a class discussion with a guest speaker related to light signals, such as airport lighting systems, traffic light programming, stage light programming, or message scoreboard programming.	
Build a continuity tester or a game board for matching related items. Test for complete circuits on the selected product.	Illinois, Introducing the Exploration Series, pp. 37-61.

Content Outline **Teacher Plans and Activities**

- **IV. Communication Technology**
  - **F. Other Communication Systems**
    - 2. Other Acoustical (Audio) Systems
      - a. Musical Instruments
        - (1) Piano
        - (2) Organ
        - (3) Percussion
        - (4) Strings
        - (5) Woodwind and Brass (Air Columns)
      - b. Other Non-Electrical Sound Systems
        - (1) Mechanical Alarm Clock
        - (2) Church Bells
        - (3) Pneumatic Sirens or Horns
        - (4) Drums
        - (5) Teakettle
        - (6) Tap Wall for Studs
        - (7) Railroad Steam Whistle
        - (8) Other
    - 3. Tactile Systems
      - a. Texture
        - (1) Surface Texture
        - (2) Object Shape
        - (3) Braille
        - (4) Raised Labels
        - (5) Baseball Warning Track
        - (6) Highway Center Line Bumps or Rumble Strip
        - (7) Other
      - b. Movement
        - (1) Body Tension
        - (2) Vibrating Pins (Opticon Scanner)
        - (3) Faulty Machinery
        - (4) Low Voltage Shock Alert
        - (5) Escalator/Elevator
        - (6) Water Current
        - (7) Other
      - c. Temperature
        - (1) Radiation of Heat/Cold
        - (2) Water Faucets
        - (3) Friction of Machines
        - (4) Medical Indicator
        - (5) Other

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to other audio systems.	
Participate in a class discussion with a music instructor explaining how sound varies among different musical instruments.	
In small groups develop an audio tape of two to five minutes describing a given theme or situation, such as farm machines, farm animals, getting ready for school or work, time to eat, arriving home, garbage pickup, baseball game, classroom, leaving for school or work, sports practice, peace and tranquillity, birds, traffic, a parade, park activities, etc. Play the tapes for the class and have them identify the theme or situation.	
In small groups build a security detection system using a light signal or an audio signal.	Fales, Technology Today and Tomorrow, pp. 116-121.
Create a coded signal to send message between two rooms.	Illinois, Communication Technology Curriculum Guide, pp. 56.
Participate in a class discussion related to tactile, olfactory and gustatory systems of communication.	
Participate in a group activity in which each individual reaches into a bag of varied objects and, using only tactile perception to identify the objects, sketches the object perceived. After each person has drawn several objects, discuss the reactions of class members.	Texas, Communication Systems Guide, pp. 48-50.

Content Outline	Teacher Plans and Activities

IV. Communication Technology

- **F. Other Communication Systems**
  - **3. Tactile Systems**
    - d. Location or Sequence
      - (1) Telephone Dial
      - (2) Keyboard
      - (3) Water Faucets
      - (4) Light Switches
      - (5) Cash Register Drawer
      - (6) Furniture Arrangement
      - (7) Money Arrangement (Billfold)
      - (8) Clothes Arrangement
      - (9) Food Arrangement on Plate
      - (10) Other
  - 4. Olfactory/Smell Systems
    - a. Smoke
    - b. Scratch and Sniff Products
    - c. Chemicals
    - d. Perfumes
    - e. Scented Products
    - f. Food Product Discrimination
    - g. Medical Indicator
    - h. Other
  - 5. Gustatory/Taste Systems
    - a. Flavored Products
    - b. Medical Indicator
    - c. Food Seasoning Discrimination
    - d. Edible Food Discrimination
    - e. Other

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Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a series of experiences emphasizing sensory perceptions other than sight and hearing. Work in pairs with one serving as the guide and the other blindfolded, each student will assume one role for half of the experiences. Complete a worksheet indicating their responses and reaction to each experience.	Sensory Perception Worksheet.
Station 1-Tactile: Turn on a light switch as you enter the room noting its height and the direction of "on". Run water from either a hot or a cold faucet; touch each faucet to identify which faucet was used. Note the location of the hot faucet in relationship to the cold faucet.	Classroom or restroom.
Station 2-Tactile: Learn the position of the numbers on a 10-key adding machine. Print the numbers in order, add the four numbers given on a worksheet and retain the tape verifying the work.	10-key adding machine.
Station 3-Tactile: From four dishes containing finger foods, place a tablespoon of food from each dish on a plate in a specified location using clock position. Eat the food from the plate in a specified sequence using a spoon for at least one item.	Suggested products: corn chips, crackers, carrots, M & M's, nuts, mints or raisins, etc.
Station 4-Tactile: Sort a given pile of change into four containers placed in order of increasing value from right to left and gather the amounts of change specified on the worksheet.	
Station 5-Olfactory: Smell the contents of each of the sequentially numbered bottles, identify the contents and write it on the worksheet.	Suggested products: ammonia, vinegar, vanilla, clorox, Dr. Pepper, Coke, tea, coffee, water, fruit juices, fabric softener, shampoo, perfume, nail polish/remover, scratch and sniff samples, etc.
Station 6-Gustatory: From each of a series of bowls containing dry (or liquid) food products, place 1/8th teaspoon or less of a product in the participants hand for tasting, identify the contents and write it on the worksheet.	Suggested products: salt, sugar, baking soda, grape, orange, lemonade, cherry, strawberry Kool Aid mix, pepper, powdered chocolate, cinnamon, powdered or brown sugar, etc.
Participate in a small group problem solving activity to develop a system for a visually impaired person to arrange clothing in a closet to allow for daily wardrobe selection.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Hacker, et al., Living With Technology, Delmar, 1988, pp. 124-126.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 166-170.
Heiner, et al., People Create Technology, Davis, 1980, pp. 175.

Selected Readings On Communication

DuVall, et al., Getting The Message: The Technology of Communication, Davis, 1981, pp. 47-72, 174-183.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 6-11, 178.

Revision Notes:

Lesson Title: Selected Emerging Areas: Communication Technology

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of energy and power technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this lesson each student will learn fundamental concepts and skills related to several significant examples of emerging developments in communication technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: closed-caption, pager/beeper.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish between a teleconference and a videoconference. *ITE 3.16*
4. Recognize that technological change is continuous, has an effect on humans, and is brought about by human action; therefore, each individual may assume a responsible role in directing technological change. *ITE 2.19*
5. List or select from a list visual communication devices/services that have been developed within the past decade.
6. List or select from a list audio communication devices/services that have been developed within the past decade.
7. List or select from a list audio-visual communication devices/services that have been developed within the past decade.
8. List or select from a list integrated communication technology devices/services that have been developed within the past decade.
9. Describe the use of lasers and fiber optics in communication technology. *ITE 3.16, 3,20*
10. Experiment with and/or construct a device using lasers and fiber optics for communication following proper safety procedures. *ITE 2.18, 3.16, 3.20*
11. State at least one potential trend in communication technology.
12. Gather pertinent information, formulate and express an opinion related to the social/cultural issues in communication technology. *ITE 2.7, 2.8 , 2.19*

Content Outline	Teacher Plans and Activities

IV. Communication Technology
- G. Selected Emerging Areas: Communication Technology
  - 1. New Concepts/Devices/Services
    - a. Video Systems
      - (1) Word Processor
      - (2) Desktop Publishing
      - (3) Computer Printers (Ink Jet, Laser, Heat Transfer)
      - (4) Closed-Caption Message
    - b. Audio Systems
      - (1) Compact Disk Recorders
      - (2) Pagers/Beepers
      - (3) Teleconference
      - (4) Expanded Telephone Service Options
    - c. Audio-Visual Systems
      - (1) 3-D Imaging
      - (2) Automobile Monitor/Control
      - (3) Stereo Television
      - (4) SAT Television Receiver (Audio Language Translation)
      - (5) Two-Way Cable Television
        - (a) Pay-Per-View
        - (b) Shop At Home
        - (c) Data Base Inquiry
      - (6) Closed Circuit Television
      - (7) Videophone
      - (8) Centralized Television Viewing
    - d. Integrated Communication Technology Systems
      - (1) Laser
      - (2) Fiber Optics
      - (3) Satellite Dish/Receiver Scrambler/Decoder/ Tuner
      - (4) Computer Integrated Manufacturing
      - (5) Self-Repairing Computers
      - (6) Facsimile

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Maintain a diary throughout this lesson making entries which reflect individual thoughts and opinions related to how the topics affect the individual, what feelings they have related to the perceived effects, and what related action they might like to take.	
Participate in class discussion related to definitions of closed-caption, and pager/beeper; new concepts, devices and services in communication used in industry, the school and the home.	
View a film or video tape related to new concepts, devices and services in communication.	
Participate in an experiment sending light through a fiber optic cable using a flashlight.	Illinois, Communication Technology Curriculum Guide, pp. 55-56.
Observe a class demonstration showing how to build communication devices using lasers and/or fiber optics.	
Build a laser/fiber optics voice communication system.	Utah, Industrial Arts--Agriculture, pp. "Laser/Fiber Optic Communication".
Participate in a class discussion led by a representative of the telephone company on the subject of fiber optic systems.	Seymour, Exploring Communications, pp. 215.
Demonstrate to the class how a selected product represents current communication technology; or describe the findings of an article from a recent periodical related to current communication technology.	

Content Outline	Teacher Plans and Activities

IV. Communication Technology

G. Selected Emerging Areas

2. Potential Trends In Communication Technology
    - a. Computerized Medical Diagnositic and Prescription Machines
    - b. Transmission--Analog to Digital Conversion
    - c. Decline in Print Media
    - d. Videoconferencing, Home Banking and Home Shopping
    - e. Mobile Communication Systems
    - f. Computerized Medical Language Translation
    - g. Increased Use of Non-Film Photography
3. Current Social/Cultural Issues in Communication Technology
    - a. Copyright Protection/Access to Information
    - b. Freedom of Speech/Censorship
    - c. Monopoly of Ownership/Restricted Information
    - d. Government Regulation/Universal Availability of Service
    - e. Right to Privacy/Freedom of Information

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in class discussion related to potential trends and current social/cultural issues in communication technology.	
View a film or video tape related to communication satellites.	"Audio/Visual Catalog", Current Edition, National Aeronautics and Space Administration, Marshall Space Flight Center, Marshall Space Flight Center, AL 35812.
Participate in class discussion led by a person from the community concerned with the application of copyright laws to computer software and to copy machines, freedom of the press and censorship, right of privacy and freedom of information, government deregulation in the telephone industry, and control of satellite communication systems, such as representatives from area radio, television, newspaper or telephone company; computer or satellite receiver distributor; or government communication regulation agencies.	
Play "Win, Lose, or Draw" game using vocabulary related to communication.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

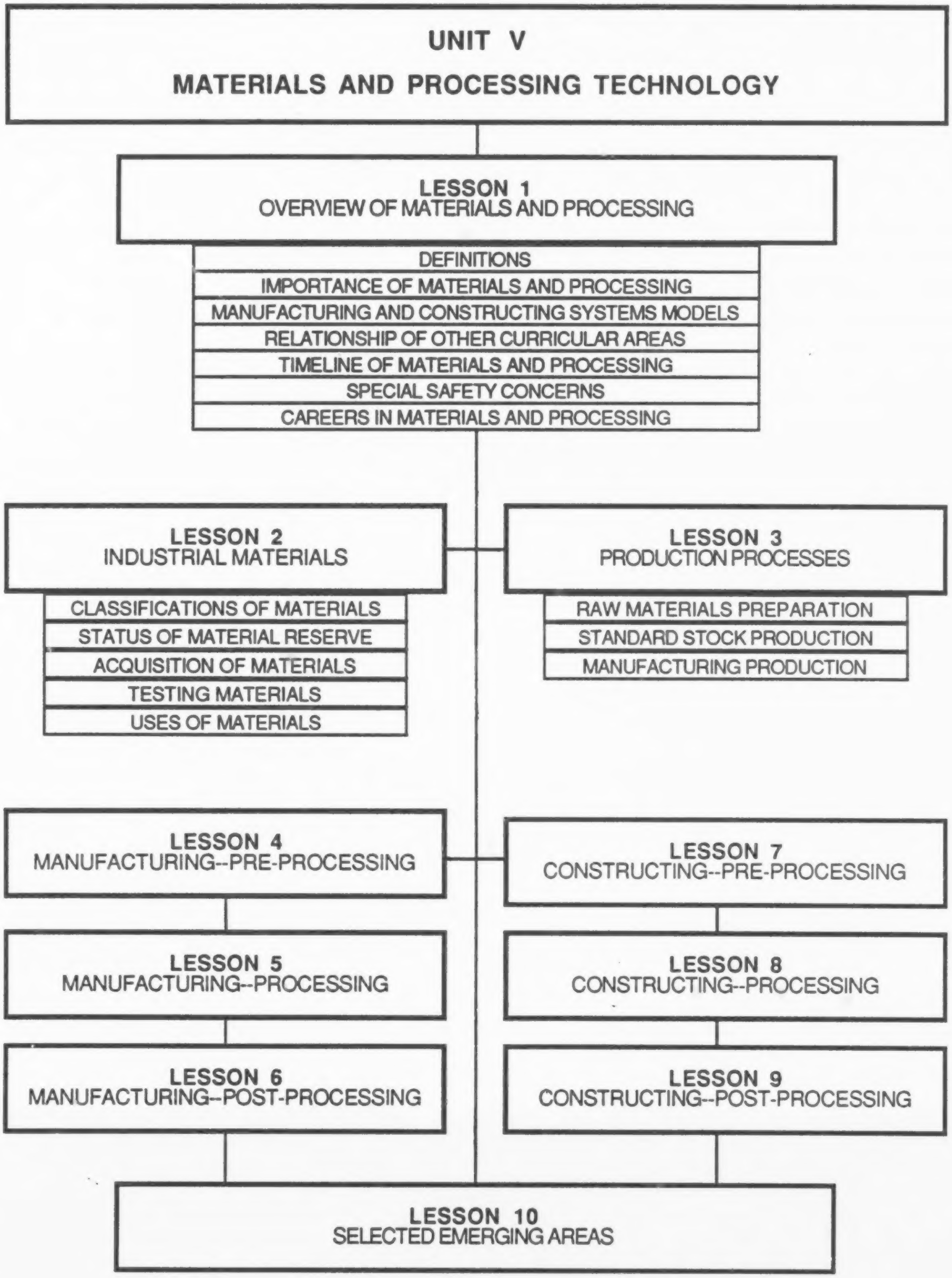
Goetsch, et al., Technology and You, Delmar, 1987, pp. 413-431.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 194-197, 482-494.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 181-201, 360-370.
Heiner, et al., People Create Technology, Davis, 1980, pp. 18-22.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 238-242.
Williams, et al., Technology At Work, South-Western, 1987, pp. 31-38, 285-287.

Selected Readings On Communication

DuVall, et al.,Getting The Message: The Technology of Communication, Davis, 1981, pp. 241-300.
Jones, et al., Discovering Communication Technology, Harcourt, Brace, & Jovanovich, 1986, pp. 254-256.
Seymour, et al., Exploring Communications, Goodheart-Willcox, 1987, pp. 263-268.

Most issues of Popular Science will show new developments in communication technology.

Revision Notes:


UNIT V
MATERIALS AND PROCESSING TECHNOLOGY
LESSON 1
OVERVIEW OF MATERIALS AND PROCESSING
DEFINITIONS
IMPORTANCE OF MATERIALS AND PROCESSING
MANUFACTURING AND CONSTRUCTING SYSTEMS MODELS
RELATIONSHIP OF OTHER CURRICULAR AREAS
TIMELINE OF MATERIALS AND PROCESSING
SPECIAL SAFETY CONCERNS
CAREERS IN MATERIALS AND PROCESSING
LESSON 2
INDUSTRIAL MATERIALS
CLASSIFICATIONS OF MATERIALS
STATUS OF MATERIAL RESERVE
ACQUISITION OF MATERIALS
TESTING MATERIALS
USES OF MATERIALS
LESSON 3
PRODUCTION PROCESSES
RAW MATERIALS PREPARATION
STANDARD STOCK PRODUCTION
MANUFACTURING PRODUCTION
LESSON 4
MANUFACTURING--PRE-PROCESSING
LESSON 5
MANUFACTURING--PROCESSING
LESSON 6
MANUFACTURING--POST-PROCESSING
LESSON 7
CONSTRUCTING--PRE-PROCESSING
LESSON 8
CONSTRUCTING--PROCESSING
LESSON 9
CONSTRUCTING--POST-PROCESSING
LESSON 10
SELECTED EMERGING AREAS

UNIT V: MATERIALS AND PROCESSING TECHNOLOGY

A. Overview of Materials and Processing Technology
   1. Definitions
      a. Manufacturing
      b. Construction (Constructing)
      c. Production
   2. Importance of Materials and Processing in Technology
   3. Manufacturing and Constructing Systems Models
   4. Relationship of Other Curricular Areas to Materials and Processing Technology
      a. Scientific Principles
      b. Mathematical Applications
      c. Social/Cultural Interaction
      d. Language Arts Applications
   5. Timeline of Materials and Processing
      a. Relationship of Materials to Early Eras
         (1) Stone Age
         (2) Bronze Age
         (3) Iron Age
      b. Effect of Agriculture
      c. Movement Toward Urbanization
      d. Impact of Trade/Economy
      e. Development of Manufacturing
         (1) Domestic System
            (a) Meet Family Needs
            (b) Family Owned/Made
            (c) Handmade
         (2) Cottage Industry
            (a) Meet Community Needs
            (b) Family Specialization
            (c) Family Owned/Made
            (d) Handmade
         (3) Factory System
            (a) Meet Community Needs
            (b) Company Owned
            (c) Hired Employees
            (d) Steam and Water Power
            (e) Began Industrial Revolution
            (f) Frequent Labor Abuse
            (g) Interchangeable Parts
            (h) Moving Assembly Line
      f. Structural Contributions
         (1) Egyptian Structures
            (a) Dams and Canals
            (b) Pyramids/Tombs
         (2) Greek/Roman Structures
            (a) Aqueducts and Roads
            (b) Public Baths/Coliseums
         (3) Renaissance Structures
            (a) Byzantine and Gothic Cathedrals
            (b) Windmills
            (c) Castles
         (4) Early Modern Structures
            (a) Eiffel Tower
            (b) Concrete Roads
            (c) Skyscrapers

6. Special Safety Concerns
    a. Manufacturing
        (1) Past Records
        (2) Potential Hazards
        (3) Equipment Safety Guards
        (4) Personal Protective Equipment
    b. Constructing
        (1) Past Records
        (2) Potential Hazards
        (3) Equipment Safety Guards
        (4) Personal Protective Equipment
7. Careers in Materials and Processing
    a. Selected Manufacturing Occupations
        (1) Professional
            (a) Engineer
            (b) Accountant
            (c) Scientist
            (d) Plant Manager
            (e) Officers
        (2) Supervisory
            (a) Production Supervisor
            (b) Shipping Supervisor
            (c) Materials Inventory Supervisor
        (3) Technical
            (a) Designer
            (b) Drafter
            (c) Quality Control Inspector
            (d) Materials Tester
            (e) Lab Technician
        (4) Skilled
            (a) Machinist
            (b) Electrician
            (c) Metal Fabricator
            (d) Tool and Die Maker
            (e) Millwright
        (5) Semi-Skilled
            (a) Machine Operator
            (b) Truck Driver
            (c) Materials Handler
        (6) Unskilled
            (a) Laborer
            (b) Plant and Grounds Worker
            (c) Janitor
    b. Selected Construction Occupations
        (1) Professional
            (a) Architect
            (b) Civil Engineer
            (c) Structural Engineer
            (d) Mechanical Engineer
            (e) Electrical Engineer
        (2) Technical
            (a) Drafter
            (b) Checker
            (c) CADD Technician
        (3) Supervisory
            (a) Foreman
            (b) Superintendent
            (c) Contractor

            - (4) Skilled Trades
                - (a) Carpenter
                - (b) Mason
                - (c) Electrician
                - (d) Plumber
                - (e) Heating and Cooling Mechanic
            - (5) Service
                - (a) Real Estate Agent
                - (b) Wholesale Sales Rep
                - (c) Retail Sales Rep
- B. Industrial Materials
    - 1. Classifications of Materials
        - a. Families of Materials
            - (1) Metals
            - (2) Polymers/Plastics
            - (3) Rock/Minerals/Ceramics
            - (4) Plant Materials
                - (a) Wood
                - (b) Natural Fibers
            - (5) Animal Materials
            - (6) Composites
            - (7) Chemicals/Water/Air
        - b. Properties of Materials
            - (1) Physical
            - (2) Chemical
            - (3) Mechanical
            - (4) Thermal
            - (5) Electrical
            - (6) Magnetic
            - (7) Optical
            - (8) Acoustical
        - c. Structure of Materials
            - (1) Gas
            - (2) Liquids
            - (3) Solids
                - (a) Molecular Chains
                - (b) Platelets
                - (c) Crystals
        - d. Functions of Materials
            - (1) Monolithic
            - (2) Combination
                - (a) Mixture
                - (b) Layers
            - (3) Dynamic
                - (a) Metamorphic
                - (b) Expandable
                - (c) Functional
    - 2. Status of Material Reserve
        - a. Exhaustible Supply
        - b. Inexhaustible Supply
        - c. Renewable Supply
        - d. Recyclable Supply
    - 3. Acquisition of Materials
        - a. Locating
            - (1) Determined Areas
            - (2) Undetermined Areas

- b. Securing
  - (1) Mining
  - (2) Drilling
  - (3) Harvesting
    - (a) Plant
    - (b) Animal
- c. Transporting
- d. Assessing Impact

- 4. Testing of Materials
  - a. Destructive/Nondestructive
  - b. Dynamic/Static
  - c. Field/Laboratory
- 5. Uses of Materials
  - a. By Families of Materials
    - (1) Metal Products
    - (2) Polymer/Plastic Products
    - (3) Rock/Mineral/Ceramic Products
    - (4) Wood Products
    - (5) Natural Fiber Products
    - (6) Animal Material Products
    - (7) Composite Products
    - (8) Chemicals/Water/Air
  - b. By Production Subsystems
    - (1) Processing Raw Materials
    - (2) Manufacturing
    - (3) Construction
    - (4) Food and Agriculture Production
    - (5) Textile Production
    - (6) Energy Production
    - (7) Chemical Production

- C. Raw Materials Preparation Processes
  - 1. Cleaning
    - a. Washing
    - b. Screening/Filtering
    - c. Settling/Floating
    - d. Cutting
    - e. Peeling/Stripping/Husking/Shelling/Scaling/Skinning
  - 2. Bulking
    - a. Measuring/Weighing/Sizing
    - b. Sorting/Classifying/Grading
    - c. Piling/Collecting
    - d. Unitizing/Packaging
- D. Standard Stock Production Processes
  - 1. Butchering (Animal Sides/Quarters)
  - 2. Distilling (Petroleum)
  - 3. Melting (Metals, Plastic Resins)
  - 4. Evaporating (Sugar, Salt)
  - 5. Filtering (Paper)
  - 6. Roasting (Chocolate, Cement)
  - 7 Weaving (Cloth)
  - 8. Rolling (Metal)
  - 9. Casting (Bricks)
- E. Manufacturing Production Processes
  - 1. Measuring and Laying Out
  - 2. Separating (Remove Excess)
    - a. Mechanical
      - (1) Shearing

- (2) Machining (Chips)
  - (a) Sawing
  - (b) Milling
  - (c) Drilling
  - (d) Shaping
  - (e) Planing
  - (f) Grinding
  - (g) Abrading
  - (h) Turning

b. Thermal
c. Chemical
d. Other

3. Forming (Redistributing Mass)
   - a. Casting/Molding
   - b. Pressing/Stretching
   - c. Extruding
   - d. Forming/Forging
   - e. Bending
   - f. Other
4. Combining (Adding Materials)
   - a. Mixing/Formulating
   - b. Assembling/Fastening
     - (1) Adhesion (Surface Bond)
       - (a) Gluing
       - (b) Soldering
       - (c) Printing
       - (d) Painting
       - (e) Other
     - (2) Cohesion (Molecular Bond)
       - (a) Oxyacetylene Welding
       - (b) Thermal Welding of Plastics
       - (c) Other
     - (3) Mechanical Fasteners
       - (a) Threaded (Bolts, Screws)
       - (b) Nonthreaded (Nails, Rivets)
       - (c) Sewing
       - (d) Other
   - c. Weaving/Interlacing
   - d. Coating/Plating
5. Conditioning (Changing Internal Structure)
   - a. Thermal
     - (1) Dry
     - (2) Temper
     - (3) Freeze
     - (4) Fire
     - (5) Anneal
   - b. Mechanical
     - (1) Peen
     - (2) Explosive Form
     - (3) Forge
   - c. Magnetic
     - (1) Magnetize Steel
     - (2) Electrostatic Spraying

- d. Chemical
  - (1) Alloy
  - (2) Catalyst
  - (3) Cement Set
  - (4) Film Development
  - (5) Fermentation
  - (6) Electrolysis
  - (7) Battery
- e. Acoustical (Ultrasound Tests)
- f. Optical (Light Sensitive Glasses)
- g. Electrical (Electric-Discharge Machining)

F. Manufacturing Technology

- 1. Types of Manufacturing Systems
  - a. Custom
  - b. Intermittent
  - c. Continuous
- 2. Establishing a Manufacturing Enterprise
  - a. Organizing an Enterprise
  - b. Financing an Enterprise
- 3. Legal Responsibilities in Manufacturing
  - a. Permits
  - b. Contracts
  - c. Liability
  - d. Guarantees
  - e. Product Recall
  - f. Environment
  - g. Patents/Trademarks
  - h. Other
- 4. Selected Manufacturing Resources
  - a. Materials
  - b. Tools and Machines
  - c. Human
  - d. Capital
  - e. Time
- 5. Processes of Manufacturing
  - a. Planning the Product
    - (1) Designing the Product
      - (a) Identifying the Needs
      - (b) Completing Feasibility Studies
      - (c) Preparing Design Solution
      - (d) Building A Prototype/Mockup
      - (e) Completing Working Drawings
      - (f) Writing Specifications
      - (g) Incorporating Design Changes
    - (2) Analyzing the Production Needs
      - (a) Size and Shape of Each Part
      - (b) Number of Parts and Products Needed
      - (c) Materials to be Used
      - (d) Equipment Needed
      - (e) Employees Needed
      - (f) Production Rate
    - (3) Securing the Resources
      - (a) Materials
      - (b) Equipment
      - (c) Employees

- (4) Establishing Control Systems
  - (a) Material Inspection
  - (b) Labor Standards
  - (c) Equipment Rates
  - (d) Product Inspection
- (5) Establishing Safety Systems
  - (a) Education
  - (b) Encouragement
  - (c) Enforcement
  - (d) Equipment
  - (e) Engineering

b. Producing the Product
- (1) Scheduling Production
  - (a) Charts, Sheets, and Diagrams
  - (b) Plant Layouts
- (2) Designing the Tooling
  - (a) Jigs
  - (b) Fixtures
  - (c) Dies
  - (d) Patterns
  - (e) Gauges
  - (f) Other
- (3) Making the Product
  - (a) Processing Operations
  - (b) Assembling Operations
  - (c) Finishing Operations
- (4) Monitoring Production
  - (a) Labor Efficiency
  - (b) Material Quality
  - (c) Equipment Efficiency
  - (d) Product Quality
  - (e) Environment/Safety
  - (f) Scheduled Maintenance
  - (g) Unscheduled Maintenance
  - (h) Manufacturing Records

c. Marketing the Product
- (1) Developing Marketing Plans
  - (a) Product
  - (b) Price
  - (c) Promotion
  - (d) Distribution
  - (e) Service
  - (f) Maintenance
- (2) Advertising the Product
  - (a) Attention
  - (b) Interest
  - (c) Information
  - (d) Action
- (3) Packaging the Product
  - (a) Contain
  - (b) Identify
  - (c) Protect
  - (d) Display
- (4) Distributing and Selling the Product
  - (a) Warehousing
  - (b) Transporting
  - (c) Marketing Wholesale
  - (d) Marketing Retail

- d. Servicing the Product
  - (1) Installing Product
  - (2) Maintaining Product
  - (3) Repairing/Replacing Product
  - (4) Recycling/Disposing of Product
- G. Construction Technology
  - 1. Types of Structures
    - a. Buildings
      - (1) Residential Buildings
      - (2) Commercial Buildings
      - (3) Industrial Buildings
    - b. Transportation Systems
      - (1) Pathways
      - (2) Bridges
      - (3) Tunnels
    - c. Utility Systems
      - (1) Physical Plants
      - (2) Distribution/Collection Network
    - d. Special Structures
      - (1) Pneumatic Structures
      - (2) Space Structures
      - (3) Manufactured Housing
      - (4) Other
  - 2. Establishing a Construction Enterprise
    - a. Organizing an Enterprise
    - b. Financing an Enterprise
  - 3. Legal Responsibilities in Construction
    - a. Legal Land Description
      - (1) Metes and Bounds
      - (2) U.S. Public Land Survey
      - (3) Lot and Block
      - (4) State Plane Coordinate
    - b. Zoning Laws
      - (1) Major City Zones
        - (a) Single Family
        - (b) Multiple Family
        - (c) General Shopping
        - (d) Commercial
        - (e) Light Industrial
        - (f) Heavy Industrial
      - (2) Structural Restrictions
        - (a) Minimum Lot Size
        - (b) Maximum Building Size Per Lot
        - (c) Maximum Building Height
        - (d) Minimum Floor Space
        - (e) Other
    - c. Building Codes
    - d. Contracts
    - e. Mechanics Lien
    - f. Liability
    - g. Guarantee
    - h. Environment
    - i. Other

4. Selected Construction Resources
    - a. Materials
        - (1) Concrete/Masonry
        - (2) Wood
        - (3) Metal
        - (4) Glass
        - (5) Other
    - b. Machines and Tools
        - (1) Heavy Equipment
        - (2) Light Equipment
        - (3) Portable Power Equipment
        - (4) Hand Tools
    - c. Human
        - (1) Professional
        - (2) Management
        - (3) Labor
        - (4) Other
    - d. Capital
    - e. Time
5. Processes of Construction
    - a. Planning the Project
        - (1) Designing the Project
            - (a) Identifying the Needs
            - (b) Completing Feasibility Studies
            - (c) Preparing Design Solution
            - (d) Completing Drawings
            - (e) Writing Specifications
            - (f) Adding Design Changes
        - (2) Analyzing Project Needs
            - (a) Scope of the Project
            - (b) Completion Date
            - (c) Project Bids
        - (3) Contracting For Resources
            - (a) Materials
            - (b) Equipment
            - (c) Employees
        - (4) Establishing Control Systems
            - (a) Project Inspection
            - (b) Material Inspection
            - (c) Labor Standards
            - (d) Equipment Rates
        - (5) Establishing Safety Systems
            - (a) Education
            - (b) Encouragement
            - (c) Enforcement
            - (d) Equipment
            - (e) Engineering
        - (6) Planning the Site
            - (a) Selecting Site
            - (b) Obtaining Site
            - (c) Surveying Site
        - (7) Preparing to Build
            - (a) Obtaining Building Permits
            - (b) Laying Out Planned Structure
            - (c) Obtaining Utilities
            - (d) Maintaining Site Safety/Security

b. Building the Structure
  (1) Scheduling Construction
    (a) Bar Chart Method
    (b) Critical Path Method
  (2) Clearing the Site
    (a) Wrecking
    (b) Breaking
    (c) Blasting
    (d) Salvaging
    (e) Moving
  (3) Doing the Earthwork
    (a) Testing Soil
    (b) Excavating Soil
    (c) Finishing Earthwork
  (4) Building the Foundation
    (a) Slab
    (b) Footing
    (c) Pile/Pier
  (5) Building the Support Structure
    (a) Mass Structure
    (b) Bearing Wall Structure
    (c) Framed Structure
    (d) Pneumatic Structure
    (e) Space Structure
c. Enclosing the Exterior
  (1) Roof
    (a) Deck
    (b) Flashing
    (c) Roofing
    (d) Insulation
  (2) Walls
    (a) Masonry/Curtain Walls
    (b) Insulation
    (c) Siding
  (3) Doors and Windows
d. Installing Systems
  (1) Transportation Systems
    (a) Stairways/Escalators
    (b) Elevators
    (c) Conveyors
    (d) Chutes
    (e) Dumbwaiters
    (f) Pneumatic Tubes
  (2) Climate Control Systems
    (a) Temperature Control
    (b) Moisture Control
    (c) Pollution Control
  (3) Plumbing Systems
    (a) Water
    (b) Fuel
    (c) Waste
  (4) Electrical Power Systems
    (a) Residential
    (b) Commercial
    (c) Industrial

- (5) Communication Systems
  - (a) Monitor
  - (b) Exchange
- e. Completing the Project
  - (1) Enclosing Interior
    - (a) Ceilings
    - (b) Walls
    - (c) Floors
  - (2) Finishing
    - (a) Painting
    - (b) Decorating
    - (c) Trimming
    - (d) Caulking
    - (e) Covering Floors
    - (f) Installing Equipment/Fixtures/Furniture
  - (3) Constructing Accesses
  - (4) Landscaping
- f. Transferring the Project
  - (1) Final Inspection
  - (2) Closing the Contract
    - (a) Approvals
    - (b) Releases
    - (c) Warranties and Manuals
  - (3) Final Payment
- 6. Servicing/Maintaining the Structure
  - a. Protecting
    - (1) Fences
    - (2) Patrols
    - (3) Monitoring Devices
    - (4) Chains and Locks
  - b. Maintaining
    - (1) Scheduled
    - (2) Unscheduled
  - c. Repairing/Replacing
  - d. Altering/Installing
  - e. Recycling/Disposing
- H. Selected Emerging Areas: Materials & Processing Technology
  - 1. New Materials
    - a. Ultra-Light Metals
    - b. Plastics
    - c. Adhesives
    - d. Food Products
      - (1) Growth Hormones
      - (2) Halophytes (Salt Water Plants)
    - e. Lunar Minerals
  - 2. New Processes
    - a. Construction Techniques
      - (1) Self-Sufficient Communities
      - (2) Prefabricated Structures
      - (3) Flexible Use Structures
      - (4) Smart Buildings
    - b. Automated Manufacturing Systems
      - (1) Automated Processing
        - (a) Fixed Automation
        - (b) Programmable Automation
      - (2) Automated Controlling/Managing/Monitoring

            - (3) Automated Material Handling
                - (a) Machine-to-Machine Devices
                - (b) Machine-Loading Devices
            - (4) Storage/Retrieval Devices
        - c. Production in Space
            - (1) Structures in Space
            - (2) Manufacturing in Space
- 3. Innovative Tools and Equipment
    - a. Computers
        - (1) Artificial Intelligence
        - (2) Computer Aided Design
    - b. Lasers
    - c. Infra-Red Scanners
- 4. Trends in Company Ownership
    - a. Subsidiaries
    - b. Foreign Ownership
- 5. Trends in Human Factors
    - a. Human Life and Health
    - b. Human Factors Engineering
    - c. Human/Environment Interaction
    - d. Ethical Concerns
    - e. Employability/Literacy
    - f. Leisure Time

Lesson Title: Overview of Materials and Processing Technology

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this lesson each student will learn fundamental concepts and skills involving the curricular interrelationships, the historical aspects, the safety concerns, and the career opportunities in materials and processing technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: manufacturing, construction, production.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Sketch models of the components of manufacturing and of constructing systems. *ITE 5.2, 5.3*
4. State the use of materials and processing technology in communication as well as energy and power technology. *ITE 5.1, 5.10*
5. Cite examples of scientific principles, mathematical applications, social/cultural interaction, and language arts applications in the materials and processing technology of today. *ITE 2.6, 2.7, 2.9, 2.19*
6. State the unique contributions to civilization of the tools developed during the Stone Age, Bronze Age, and Iron Age. *ITE 2.19*
7. Distinguish among domestic, cottage, and factory manufacturing systems. *ITE 5.7*
8. Identify significant structures from the Egyptian, Greek/Roman, Renaissance and early modern periods and describe the contribution each made toward technology of that time and toward present day technology. *ITE 2.19*
9. State potential safety hazards of manufacturing and of constructing and describe equipment safety guards and personal protective equipment which have been developed to provide safer working conditions in these industries.
10. Select from a list of occupations those found in manufacturing and/or in constructing and describe the type of work involved in each occupation. *ITE 2.17*
11. Match occupations in manufacturing and constructing with the educational/skill level required for that occupation and with the classification level of that occupation. *ITE 2.17, 5.6*

Content Outline

Teacher Plans and Activities

- V. Materials and Processing Technology
  - A. Overview of Materials and Processing Technology
    - 1. Definitions
      - a. Manufacturing
      - b. Construction (Constructing)
      - c. Production
    - 2. Importance of Materials and Processing in Technology
    - 3. Manufacturing and Constructing Systems Models
    - 4. Relationship of Other Curricular Areas to Materials and Processing Technology
      - a. Scientific Principles
      - b. Mathematical Applications
      - c. Social/Cultural Interaction
      - d. Language Arts Applications
    - 5. Timeline of Materials and Processing
      - a. Relationship of Materials to Early Eras
        - (1) Stone Age
        - (2) Bronze Age
        - (3) Iron Age
      - b. Effect of Agriculture
      - c. Movement Toward Urbanization
      - d. Impact of Trade/Economy
      - e. Development of Manufacturing
        - (1) Domestic System
          - (a) Meet Family Needs
          - (b) Family Owned/Made
          - (c) Handmade
        - (2) Cottage Industry
          - (a) Meet Community Needs
          - (b) Family Specialization
          - (c) Family Owned/Made
          - (d) Handmade
        - (3) Factory System
          - (a) Meet Community Needs
          - (b) Company Owned
          - (c) Hired Employees
          - (d) Steam/Water Power
          - (e) Began Industrial Revolution
          - (f) Frequent Labor Abuse
          - (g) Interchangeable Parts
          - (h) Moving Assembly Line

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook materials related to each concept introduced.	
Participate in class discussion involving definitions of manufacturing, construction, and production; the importance of materials and processing in other technologies; systems model for manufacturing and constructing, and curricular relationships related to materials and processing technology.	
Sketch systems models for manufacturing and constructing technological systems.	
Participate in a small group to research materials used for tools of the Stone, Bronze and Iron Ages; the interrelationship of agriculture, urbanization and trade with materials and processing technology; and the development of manufacturing technology. Be prepared to discuss the findings in class.	MAVCC, Exploring Technology Education, pp. ETE-13-D, ETE-25-D, ETE-27-D, ETE-31-D.

- **V. Materials and Processing Technology**
  - **A. Overview of Materials and Processing**
    - **5. Timeline of Materials and Processing**
      - f. Structural Contributions
        - (1) Egyptian Structures
          - (a) Dams and Canals
          - (b) Pyramids/Tombs
        - (2) Greek/Roman Structures
          - (a) Aqueducts and Roads
          - (b) Public Baths/ Coliseums
        - (3) Renaissance Structures
          - (a) Byzantine and Gothic Cathedrals
          - (b) Windmills
          - (c) Castles
        - (4) Early Modern Structures
          - (a) Eiffel Tower
          - (b) Concrete Roads
          - (c) Skyscrapers
    - 6. Special Safety Concerns
      - a. Manufacturing
        - (1) Past Records
        - (2) Potential Hazards
        - (3) Equipment Safety Guards
        - (4) Personal Protective Equipment
      - b. Constructing
        - (1) Past Records
        - (2) Potential Hazards
        - (3) Equipment Safety Guards
        - (4) Personal Protective Equipment
    - 7. Careers in Materials and Processing
      - a. Selected Manufacturing Occupations
        - (1) Professional
          - (a) Engineer
          - (b) Accountant
          - (c) Scientist
          - (d) Plant Manager
          - (e) Officers
        - (2) Supervisory
          - (a) Production Supervisor
          - (b) Shipping Supervisor
          - (c) Materials Inventory Supervisor

Suggested Student Activities	References/AV/Supplies/Equipment
Write a research paper of approximately three pages describing a selected early structure and its contribution to the technology of that time and to present day technology. Sketches or photos may be added to further describe the structure. These papers may be compiled for a given class, duplicated, published as a booklet, and distributed to the class members. (see Unit I, Lesson 3)	Harms, Manufacturing Technology Activities, pp. 4-8.
Participate in class discussion with teachers from other curricular areas investigating possible interrelationships between the development of selected early structures and the principles included in the sciences, mathematics, social sciences, and language arts curriculums of today.	Fales, Technology: Today and Tomorrow, pp. 198-199, 398-399.
Add to the technology timeline significant technological developments related to materials and processing technology.	
Participate in class discussion related to potential safety hazards of manufacturing and of constructing, equipment safety guards that have been developed, and personal protective equipment available to provide safer working conditions.	
Compile a list of occupations related to manufacturing and/or to constructing. Review the differences among professional, technical, skilled, supervisory, sales, and service occupational classifications. Complete a worksheet classifying the occupation as manufacturing and/or constructing, selecting the classification level of each occupation, and describing the type of work in each occupation.	
Select at least two occupations and research information about the skill and the educational requirements, the long-range potential for employment in that occupation, and working conditions. Participate in a class discussion related to manufacturing and/or to constructing occupations.	MAVCC, Exploring Technology Education, pp. ETE-33-D.

Content Outline	Teacher Plans and Activities

V. Materials and Processing Technology
  A. Overview of Materials and Processing
    7. Careers in Materials and Processing
      a. Selected Manufacturing Occupations
        (3) Technical
          (a) Designer
          (b) Drafter
          (c) Quality Control Inspector
          (d) Materials Tester
          (e) Lab Technician
        (4) Skilled
          (a) Machinist
          (b) Electrician
          (c) Metal Fabricator
          (d) Tool and Die Maker
          (e) Millwright
        (5) Semi-Skilled
          (a) Machine Operator
          (b) Truck Driver
          (c) Materials Handler
        (6) Unskilled
          (a) Laborer
          (b) Plant/Grounds Worker
          (c) Janitor
      b. Selected Construction Occupations
        (1) Professional
          (a) Architect
          (b) Civil Engineer
          (c) Structural Engineer
          (d) Mechanical Engineer
          (e) Electrical Engineer
        (2) Technical
          (a) Drafter
          (b) Checker
          (c) CADD Technician
        (3) Supervisory
          (a) Foreman
          (b) Superintendent
          (c) Contractor
        (4) Skilled Trades
          (a) Carpenter
          (b) Mason
          (c) Electrician
          (d) Plumber
          (e) Heating/Cooling Mechanic
        (5) Service
          (a) Real Estate Agent
          (b) Wholesale Sales Rep
          (c) Retail Sales Rep

Suggested Student Activities	References/AV/Supplies/Equipment
Complete a "Word Search" of construction occupations.	MAVCC, Exploring Technology Education, pp. ETE-17-C.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 11-33, 143-155, 269-284.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 124-135, 199, 314-328, 378-387, 399.
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Snelling, Robert O. Sr. and Anne M. Snelling, Jobs: What They Are: Where They Are, Simon and Schuster, 1985.
Strandh, A History of the Machine, A & W Publishers, Inc., N. Y., 1979.
U.S. Department of Labor, Dictionary of Occupational Titles, U.S. Government Printing Office.
U.S. Department of Labor, Occupational Outlook Handbook, U.S. Government Printing Office.
Wright, et al., Exploring Production, Goodheart-Willcox, 1985, pp. 130-132, 333-340, 525-529, 536-539.
Wright, Processes of Manufacturing, Goodheart-Willcox, 1987, pp. 444-445.

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Lesson Title: Industrial Materials

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to the wide variety of industrial materials and their properties as well as methods of testing the properties of these materials.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: molecular structure, elements, compounds, alloy, insulator, conductor, ferrous, thermoplastic, thermosetting, hardwood, softwood.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Outline at least two systems for classifying materials.
4. Distinguish among the families of materials listed in the content outline.
5. From a list of materials match each material with one of the families of materials.
6. Distinguish among the properties of materials.
7. From a list of examples match each example with one of the properties of materials.
8. For each of the families of materials, identify three materials which are natural resources of or are manufactured in the state of Missouri.
9. Distinguish among the classifications of the reserve of materials: exhaustible, inexhaustible, renewable, and recyclable.
10. From a list of materials classify each material according to its resource reserve.
11. Distinguish among the methods of securing materials.
12. From a list of materials match each material with the method by which it is secured.
13. State a negative environmental impact resulting from each method of securing materials.
14. From a list of materials match each material with a common application of that material in one or more production subsystems.
15. Distinguish between destructive and nondestructive testing, dynamic and static testing, and field and laboratory testing. *ITE 5.9*
16. Conduct at least three nondestructive and one destructive test of materials in laboratory. *ITE 5.11, 5.14, 5.15, 5.21*
17. Apply proper safety procedures when testing materials. *ITE 2.18, 5.11, 5.14*

Content Outline	Teacher Plans and Activities

V. Materials and Processing Technology
  B. Industrial Materials
    1. Classifications of Materials
      a. Families of Materials
        (1) Metals
        (2) Polymers/Plastics
        (3) Rock/Minerals/Ceramics
        (4) Plant Materials
          (a) Wood
          (b) Natural Fibers
        (5) Animal Materials
        (6) Composites
        (7) Chemicals/Water/Air
      b. Properties of Materials
        (1) Physical
        (2) Chemical
        (3) Mechanical
        (4) Thermal
        (5) Electrical
        (6) Magnetic
        (7) Optical
        (8) Acoustical
      c. Structure of Materials
        (1) Gas
        (2) Liquid
        (3) Solid
          (a) Molecular Chains
          (b) Platelets
          (c) Crystals
      d. Functions of Materials
        (1) Monolithic
        (2) Combination
          (a) Mixture
          (b) Layers
        (3) Dynamic
          (a) Metamorphic
          (b) Expandable
          (c) Functional
    2. Status of Material Reserve
      a. Exhaustible Supply
      b. Inexhaustible Supply
      c. Renewable Supply
      d. Recyclable Supply

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in class discussion related to definitions of molecular structure, elements, compounds, alloy, insulator, conductor, ferrous, thermoplastic, thermosetting, hardwood and softwood; classification of materials; families of materials; properties of materials; structure of materials; functions of materials and reserve of materials.	
Examine a variety of materials and products made from those materials and classify them according to the material families they represent and arrange them for public display. Include in the display a detailed map of the state of Missouri on which major bodies of water and selected natural resources found in Missouri are located.	
Participate in teacher demonstration of how to test a variety of materials for their properties by completing the example portion of a Materials Testing Worksheet. Follow safety rules.	Shackleford, Ray & David J. Schiek, "Developing Material Testing Equipment for Specific Needs", Technology Activities Idea Book 1, International Technology Education Association, pp. 33-35; Introduction To Technology Sample 7th & 8th Grade Technology Learning Activities, Field Test Edition, New York State Education Department, Module T-2, pp. 1-11; Donald Fisher & Arthur Moore, Modern Workshop Materials, Holmes McDougall Limited, pp. 78-87; Materials Technology Workbook, Modular Courses In Technology Series; Industrial Education Materials and Processes Revised, Kansas State Department of Education, pp. 52-62, 101-105; Heiner, People Create Technology, Activity Manual, pp. 81-82; Wright, Exploring Manufacturing, Instructor's Guide, pp. 14-15; Todd, Understanding and Using Technology, pp. 19-29; Harms, Manufacturing Technology Activities, pp. 9-18; Listar, Technology Activity Guide I, pp. 101-107; Utah, Industrial Arts-Agriculture, "Materials Testing"; MAVCC, Exploring Technology Education, pp. ETE-107-D.
Complete a Materials Testing Worksheet by performing specified tests on a variety of specified materials at designated work stations and by writing generalizations which were observed during the materials testing process.	
Participate in a class discussion related to the generalizations discovered during the materials testing process.	
Select one or more materials for a one- or two-page research paper describing those materials. The paper should include the sources of the material, the reserve classification of the material, the length of time involved in developing the material resource, the process of acquiring the resource, suggestions for fuller use of the resource and potential for environ-mental destruction.	
Participate in a class discussion on the benefit- and risk-tradeoffs related to the research papers on materials. (See Unit I, Lesson 3)	

Content Outline	Teacher Plans and Activities

V. Materials and Processing Technology
- **B. Industrial Materials**
  - 3. Acquisition of Materials
    - a. Locating
      - (1) Determined Areas
      - (2) Undetermined Areas
    - b. Securing
      - (1) Mining
      - (2) Drilling
      - (3) Harvesting
        - (a) Plant
        - (b) Animal
    - c. Transporting
    - d. Assessing Impact
  - 4. Testing of Materials
    - a. Destructive/Nondestructive
    - b. Dynamic/Static
    - c. Field/Laboratory
  - 5. Uses of Materials
    - a. By Families of Materials
      - (1) Metal Products
      - (2) Polymer/Plastic Products
      - (3) Rock/Mineral/Ceramic Products
      - (4) Wood Products
      - (5) Natural Fiber Products
      - (6) Animal Material Products
      - (7) Composite Products
      - (8) Chemicals/Water/Air
    - b. By Production Subsystems
      - (1) Processing Raw Materials
      - (2) Manufacturing
      - (3) Construction
      - (4) Food and Agriculture Production
      - (5) Textile Production
      - (6) Energy Production
      - (7) Chemical Production

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in the development of renewable or recyclable materials, such as planting a tree(s) or garden, developing wildlife habitat, or recycling reusable materials.	
Participate in a class discussion related to the acquisition of materials, the environmental impact of acquiring the materials, and the appropriateness of various kinds of tests for various materials and of their use in various products.	
Complete a worksheet matching a material from a list of materials with the method used to secure the material.	
View a film or video tape showing methods of acquiring raw materials and the environmental impact involved in the acquisition.	
Participate in a field trip to a local industry or in class discussion led by a representative from a local industry which involves materials testing.	
Participate in small group activity in which each group researches the products of one of the families of materials. Samples of the materials/products representing that family could be provided for examination and comparison. Each group would complete a worksheet related to the uses of those materials in the various production subsystems. Each class member may relate one unexpected finding to the entire class.	Heiner, People Create Technology, pp. 189-198; Goetch, Technology and You, pp. 68-72; Listar, Technology Activity Guide I, pp. 109-113..

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

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Bame, et al., Exploring Technology, Davis, 1980, pp. 117-118.
Bame, et al., Exploring Technology, Activity Manual, 1980, pp. 93-94.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 33-34, 68-72, 98-102, 143-149, 399.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 64-71, 260-273, 367-369.
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Lesson Title: Production Processes

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to the primary and secondary production processes.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: bulking, standard stock, cement, concrete.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish among the listed cleaning and bulking processes used in converting raw materials. *ITE 5.9, 5.16*
4. From a specified list of raw materials requiring cleaning and bulking conversions, list the conversion processes appropriate for each raw material. *ITE 5.9, 5.16*
5. Distinguish among the listed processes used in making standard stock. *ITE 5.9, 5.18*
6. From a list of standard stock items match each stock item with the process required to convert it from a raw material. *ITE 5.9, 5.18*
7. Apply metric or customary measuring and layout skills required to manufacture a product.
8. Distinguish among the major categories of manufacturing production processes. *ITE 5.9*
9. Distinguish among the types of separating processes. *ITE 5.9, 5.18*
10. Distinguish among the types of forming processes. *ITE 5.9, 5.18*
11. Distinguish among the types of combining processes. *ITE 5.9, 5.18*
12. Distinguish among the types of conditioning processes. *ITE 5.9, 5.18*
13. Safely perform sawing, drilling, planing, and abrading processes required to manufacture a product. *ITE 2.18, 5.11, 5.15*
14. Safely perform casting/molding, pressing/stretching, forming/forging, and bending processes required to manufacture a product. *ITE 2.18, 5.11, 5.15*
15. Safely perform mixing/formulating, gluing, soldering, printing, painting, and mechanical fastening processes required to manufacture a product. *ITE 2.18, 5.11, 5.15*
16. Safely perform a thermal, mechanical or chemical conditioning process required to manufacture a product. *ITE 2.18, 5.11, 5.15*

Content Outline

- V. Materials and Processing Technology
  - C. Raw Materials Preparation Processes
    - 1. Cleaning
      - a. Washing
      - b. Screening/Filtering
      - c. Settling/Floating
      - d. Cutting
      - e. Peeling/Stripping/Husking/Shelling/Scaling/Skinning
    - 2. Bulking
      - a. Measuring/Weighing/Sizing
      - b. Sorting/Classifying/Grading
      - c. Piling/Collecting
      - d. Unitizing/Packaging
  - D. Standard Stock Production Processes
    - 1. Butchering (Animal Sides/Quarters)
    - 2. Distilling (Petroleum)
    - 3. Melting (Metals, Plastic Resins)
    - 4. Evaporating (Sugar, Salt)
    - 5. Filtering (Paper)
    - 6. Roasting (Chocolate, Cement)
    - 7 Weaving (Cloth)
    - 8. Rolling (Metal)
    - 9. Casting (Bricks)
  - E. Manufacturing Production Processes
    - 1. Measuring and Laying Out
    - 2. Separating (Remove Excess)
      - a. Mechanical
        - (1) Shearing
        - (2) Machining (Chips)
          - (a) Sawing
          - (b) Milling
          - (c) Drilling
          - (d) Shaping
          - (e) Planing
          - (f) Grinding
          - (g) Abrading
          - (h) Turning
      - b. Thermal
      - c. Chemical
      - d. Other
    - 3. Forming (Redistributing Mass)
      - a. Casting/Molding
      - b. Pressing/Stretching
      - c. Extruding
      - d. Forming/Forging
      - e. Bending
      - f. Other

Teacher Plans and Activities

DEMONSTRATIONS ON PROCESSES

Todd, Understand and Using Technology, Activity Manual, pp. 31-45.

Since the combination of materials which may be used and the tools or machines available to process these materials are too numerous for all to be included in any given course, each teacher must select the operations to be taught and demonstrated in a specified course. The demonstrations on industrial processes may be based upon the materials, tools, and machines which are available and which meet the objectives identified by the individual teacher for a specified course. A matrix showing (1) the tool and machine operations necessary to process the available materials, and (2) the objectives/student activities planned for the course may be developed by the teacher to aid in selecting the processes to be taught. For each process selected, a demonstration by the teacher should precede the student activity.

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of bulking, standard stock, cement, concrete; raw material preparation processes; standard stock production processes; and manufacturing production processes.	
Participate in a demonstration/activity showing cleaning as applied to food raw materials, such as beans, nuts, corn, peas and carrots, or as applied to gravel and sand.	
Participate in a demonstration/activity showing bulking processes as applied to food raw materials, such as beans, nuts and carrots, or as applied to gravel and sand, or as applied to standard products, such as nails, nuts and bolts, coins, and buttons.	
Participate in a demonstration/activity showing the making of standard stock, such as melting aluminum to form pigs, evaporating a saline solution for salt crystals, making paper from a pulp solution, weaving a place mat, and casting bricks.	
Complete one or more of the following activities to form standard stock :	
Make plywood.	Wright, Exploring Manufacturing, Intstructor's Guide, pp. 17.
Pour concrete block.	Bame, Exploring Technology, Activity Manual, pp. 95-96.
Make paper.	Ibid. pp. 15-17.
Make abrasive stone.	Heiner, People Create Technology, Activity Manual, pp. 33-34.
Make glass.	Ibid. pp. 39-40. Hacker, Living With Technology, p. 540-543.
Make fabric.	Heiner, op. cit. pp. 83-84.
Make particle board.	Ibid. Page 107-108

Content Outline **Teacher Plans and Activities**

- **V. Materials and Processing Technology**
  - **E. Manufacturing Production Processes**
    - 4. Combining (Adding Materials)
      - a. Mixing/Formulating
      - b. Assembling/Fastening
        - (1) Adhesion (Surface Bond)
          - (a) Gluing
          - (b) Soldering
          - (c) Printing
          - (d) Painting
          - (e) Other
        - (2) Cohesion (Molecular Bond)
          - (a) Oxyacetylene Welding
          - (b) Thermal Welding of Plastics
          - (c) Other
        - (3) Mechanical Fasteners
          - (a) Threaded (Bolts, Screws)
          - (b) Nonthreaded (Nails, Rivets)
          - (c) Sewing
          - (d) Other
      - c. Weaving/Interlacing
      - d. Coating/Plating
    - 5. Conditioning (Changing Internal Structure)
      - a. Thermal
        - (1) Dry
        - (2) Temper
        - (3) Freeze
        - (4) Fire
        - (5) Anneal
      - b. Mechanical
        - (1) Peen
        - (2) Explosive Form
        - (3) Forge
      - c. Magnetic
        - (1) Magnetize Steel
        - (2) Electrostatic Spraying
      - d. Chemical
        - (1) Alloy
        - (2) Catalyst
        - (3) Cement Set
        - (4) Film Development
        - (5) Fermentation
        - (6) Electrolysis
        - (7) Battery
      - e. Acoustical (Ultrasound Tests)
      - f. Optical (Light Sensitive Glasses)
      - g. Electrical (Electric-Discharge Machining)

Suggested Student Activities	References/AV/Supplies/Equipment
View a film or visit an industrial plant showing the production of paper, cloth, aluminum, steel, bricks, lumber, plywood, and/or petroleum.	
View the necessary demonstrations and participate in the manufacture of industrial products which require measuring and laying out; shearing, sawing, drilling, planing, and abrading separating processes; casting/molding, pressing/stretching, forming/forging, and bending forming processes; mixing/formulating, gluing, printing, coating and mechanical fastening combining processes; and a thermal, mechanical, or chemical conditioning process.	Gallo, Production Technology, Instructor's Resource Guide, pp. 23-66.
After observing the related demonstrations, the following exercises may be helpful in providing experience with several industrial materials and in allowing the opportunity to perform basic operations with standard tools.	
Practice sawing various types of hardwoods, softwoods and plywood using a ripsaw, crosscut saw and backsaw.	Gallo, Production Technology, Instructor's Resource Guide, pp. 23-24.
Plane edges of two boards to make an edge butt joint using a hand plane and a try square	Ibid. pp. 24-26.
Saw curves and inside openings using a coping saw, a keyhole saw or a jigsaw.	Ibid. pp. 26-27.
Drill or bore holes in scrap pieces of wood, metal or plastic using a hand drill, a brace and bit or a drill press as appropriate.	Ibid. pp. 28-29, 35-36.
Prepare scrap pieces of wood and metal for finish using abrasive paper or abrasive cloth.	Ibid. pp. 33-34.
Drive nails in scrap pieces of wood using a claw hammer.	Ibid. pp. 31-32.
Cut scrap pieces of band iron using a hacksaw.	Ibid. pp. 45-46.
Cut scrap pieces of sheet metal using snips and/or squaring shears.	Ibid. pp. 46.
Bend sheet metal using a bar folder, a box and pan brake or a vise and board technique.	Ibid. pp. 50.
Drill pilot hole, drive screws with screwdriver.	
Electroplate steel.	Heiner, People Create Technology, Activity Manual, pp. 95-96.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 48-63.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 132-133.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 97-102, 143-149, 319-348.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 270-273, 278-353, 357-492.
Groneman, General Industrial Education, Teacher's Guide, McGraw-Hill, 1983, pp. 260-498.
Hacker, et al., Living With Technology, Delmar, pp. 213-239.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 69-87.
Heiner, et al., People Create Technology, Davis, 1980, pp. 92-94, 189-198.
Heiner, et al., People Create Technology, Activity Manual, Davis, 1980, pp. 31-34, 37-40.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, p. 136-305.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 250-260, 338-377.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 57-79.
Todd, et al., Understanding and Using Technology, Teacher's Guide, Davis, 1986, pp. 47-57.

Selected Readings and Activities On Materials and Processing Technology

Bame, et al., Exploring Technology, Activity Manual, Davis, 1980.
Gallo, et al., Production Technology, Instructor's Resource Guide, Bennett and McKnight, 1986.
Groneman, et al., General Industrial Edu. & Tech. Study Guide, McGraw-Hill, 1986, p. 71-86.
Hacker, et al., Living With Technology, Delmar, 1987.
Heiner, et al., People Create Technology, Activity Manual, Davis, 1980.
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Lux, et al., The World of Manufacturing, McKnight and McKnight, 1971, pp. 264-408.
Lux, et al., The World of Manufacturing, Laboratory Manual, McKnight and McKnight, 1971.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp. ETE-119-D to ETE-179-D.
New York, Introduction To Technology, Grade 7, Univ. of the State of New York, Albany, NY 12234.
Parke, Nelson, Parke System Catalog, 805 S. Devonshire, Springfield, MO. 65802, 1981.
Todd, et al., Understanding and Using Technology, Activity ACT Manual, Davis, 1986.
Wright, et al., Exploring Production, Goodheart-Willcox, 1985, pp. 37-125.
Wright, et al., Exploring Manufacturing, Instructor's Guide, Goodheart-Willcox, 1985.
Wright, et al., Exploring Manufacturing, Student Manual, Goodheart-Willcox, 1985. pp. 21-35.
Wright, et al., Processes of Manufacturing, Goodheart-Willcox, 1987, pp. 6-13, 42-332.

Lesson Title: Manufacturing--Pre-Processing

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to types of manufacturing systems, legal responsibilities in manufacturing, selected manufacturing resources, designing and engineering products, and developing manufacturing systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: batch processing, job-lot manufacture, liability, guarantee, bill of materials, board feet, specification sheet.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish among custom, intermittent and continuous types of manufacturing systems. *ITE 5.7*
4. Draw an organizational chart for a manufacturing company. *ITE 5.2*
5. Give at least three examples where manufacturers assume liability for their products.
6. Identify the name of a periodical or other publication which provides objective consumer information about manufactured products and use the publication to locate information about selected products or consumer concerns.
7. Match selected materials, tools and machines with their appropriate use in manufacturing. *ITE 5.9*
8. Describe several processes companies might use in developing new products.
9. Apply the problem solving process to design a selected product for manufacture. *ITE 1.6, 1.7, 1.8 , 3.13*
10. List the four factors that need to be controlled in a manufacturing process.
11. List and describe the five major phases (five E's) of a safety program.

Content Outline **Teacher Plans and Activities**

- V. Materials and Processing Technology
  - F. Manufacturing Technology
    - 1. Types of Manufacturing Systems
      - a. Custom
      - b. Intermittent
      - c. Continuous
    - 2. Establishing a Manufacturing Enterprise
      - a. Organizing an Enterprise
      - b. Financing an Enterprise
    - 3. Legal Responsibilities in Manufacturing
      - a. Permits
      - b. Contracts
      - c. Liability
      - d. Guarantee
      - e. Product Recall
      - f. Environment
      - g. Patents/Trademarks
      - h. Other
    - 4. Selected Manufacturing Resources
      - a. Materials
      - b. Tools and Machines
      - c. Human
      - d. Capital
      - e. Time
    - 5. Processes of Manufacturing
      - a. Planning the Product
        - (1) Designing the Product
          - (a) Identifying the Needs
          - (b) Completing Feasibility Studies
          - (c) Preparing Design Solution
          - (d) Building a Prototype/ Mockup
          - (e) Completing Working Drawings
          - (f) Writing Specifications
          - (g) Incorporating Design Changes

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in class discussion related to definition of terms in competency #1, types of manufacturing systems, legal responsibilities in manufacturing and selected manufacturing resources.	
Participate in making bulletin board displays related to types of manufacturing systems.	
Write a research report and/or develop a bulletin board display related to manufacturing topics, such as child labor, Slater's Mill, Henry Ford's moving assembly line, Eli Whitney and interchangeable parts, Hargreave's spinning jenny, water wheel, Benjamin Franklin's inventions, Philadelphia's Centennial Exposition.	
Following a review of company organizational formats, draw an organizational chart for a proposed manufacturing enterprise. (See Unit II, Lesson 4)	Harms, Manufacturing Technology Activities, pp. 19-24; MAVCC, Exploring Technology Education, pp. ETE-37-D.
Participate in a group activity in which pairs of students review different issues of the past year's volume of Consumers Report or similar periodical for items related to product recall, product liability suits, fraudulent advertising and other legal concerns and then report findings to the class.	
Bring to class examples of product guarantees or warranties and participate in class discussion related to the significance of the guarantees or warranties as well as to the liability which manufacturers assume for their products.	
Participate in class discussion related to approaches used to determine product need, processes used in developing new products, feasibility studies, steps in the design process, types of drawings, specifications and design changes.	Lux, The World of Manufacturing, Laboratory Manual, pp. 145-151, 322-332; Starzyk, General Industry and Technology, Student Guide, pp. 23.
Participate in the development of a bulletin board display related to recently manufactured products. Periodicals, such as Popular Science, have monthly articles on new products and some metropolitan newspapers have weekly sections on new products.	

Content Outline **Teacher Plans and Activities**

- **V. Materials & Processing Technology**
  - **F. Manufacturing Technology**
    - **5. Processes of Manufacturing**
      - **a. Planning the Product**
        - (2) Analyzing the Production Needs
          - (a) Size and Shape of Each Part
          - (b) Number of Parts and Products Needed
          - (c) Materials to be Used
          - (d) Equipment Needed
          - (e) Employees Needed
          - (f) Production Rate
        - (3) Securing the Resources
          - (a) Materials
          - (b) Equipment
          - (c) Employees
        - (4) Establishing Control Systems
          - (a) Material Inspection
          - (b) Labor Standards
          - (c) Equipment Rates
          - (d) Product Inspection
        - (5) Establishing Safety Systems
          - (a) Education
          - (b) Encouragement
          - (c) Enforcement
          - (d) Equipment
          - (e) Engineering

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in making bulletin board displays related to steps in the design process.	
After observing the needs for new or revised products at school, design a product to meet a specific need using a problem solving process. Select the name for the product, identify departments needed to manufacture the product, and select the best solution for production, include the necessary engineering drawings and bill of materials and production quantity needed. This may be manufactured in Unit V, Lesson 5.	Bame, Activity Manual, pp. 77-86; Heiner, People Create Technology, Activity Manual, pp. 43-44; Groneman, General Industrial Education and Technology, Study Guide, pp. 14-16; Fales, Technology: Today and Tomorrow, pp. 421-429; Harms, Manufacturing Technology Activities, pp. 25-28; APPENDIX B: Sample Record Keeping Forms.
Participate in class discussion related to needs which must be analyzed in product manufacturing.	
Participate in a field trip, a presentation by a guest speaker from a manufacturing firm, or a film/video tape showing manufacturing materials, equipment and employees.	Bame, pp. 140-141.
Participate in class discussion related to determining resource requirements, factors requiring control in manufacturing and major phases of a safety program.	Wright, Exploring Production, Student Manual, 47-55; Lux, The World of Manufacturing, Laboratory Manual, pp. 133-135.
Complete a worksheet matching materials, tools and machines with their appropriate use in manufacturing.	Listar, Technology Activity Guide 1, pp. 57-63.
Design and produce a safety poster appropriate for the school.	
For classes wishing to establish a class enterprise, participate in activities related to forming a company; financing a company; designing products; preparing engineering drawings, bill of materials and specification sheets; and hiring and preparing workers for the company being formed. (See Unit V Lessons 5 and 6)	Harms, Manufacturing Technology Activities, pp. 19-37; Gallo, Production Technology, Instructor's Resource Guide, pp. 72-76; Lux, The World of Manufacturing, Laboratory Manual, pp. 39-128; Fales, Technology: Today and Tomorrow, pp. 421-429; Wright, Exploring Production, Instructor's Guide, pp. 11-57; Hacker, Living With Technology, pp. 376-381; MAVCC, Exploring Technology Education, pp. ETE-75-D.
Participate in class discussion with the school purchasing officer explaining how a common product, such as milk, fuel, or a machine, is purchased.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 115-116, 119-121.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 124-163.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 150-157.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 82-102.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 254-269.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 206-231, 403-404.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 238-241, 280-292.
Williams, et al., Technology At Work, South-Western, 1987, pp. 181-193.

Selected Readings On Manufacturing

Extension Instruction and Materials Center, Systems of Technology, Laboratory Activities in Production, University of Texas at Austin, 1985, pp. 41-47, 55-61.
Feirer, et al., Production Technology, Bennett and McKnight, 1986, pp. 97-120, 358-374.
Lux. et al., The World of Manufacturing, McKnight and McKnight, 1971, pp. 27-38, 48-128, 135-189, 215-220, 433-471.
Wright, et al., Exploring Production, Goodheart-Willcox, 1985, pp. 126-206, 240-246.
Wright, et al., Processes of Manufacturing, Goodheart-Willcox, 1985, pp. 14-20, 410-413.

Revision Notes:

Lesson Title: Manufacturing--Processing

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this lesson each student will learn fundamental concepts and skills related to manufacturing products including the scheduling and monitoring of production.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.
As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: template, die, gauge, operation sheet, flow process chart, operation process chart, flow diagram.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Identify two types of charts or sheets which may be used in scheduling production.
4. Distinguish among fixed position, process and product plant layouts.
5. Distinguish between jigs and fixtures.
6. Plan, design and/or build jigs, fixtures, templates, and gauges necessary to manufacture a selected product. *ITE 2.18, 3.4 , 5.8, 5.9, 5.12, 5.15*
7. Perform the processing, assembling and finishing operations necessary to manufacture a product by using the tools and machines safely, accurately, and properly as demonstrated by the instructor. *ITE 2.18, 5.8, 5.11, 5.12 , 5.15, 5.22, 5.24*
8. Perform an operation as an assembly line worker. *ITE 2.18, 5.8, 5.15 , 5.24*
9. In all laboratory activities follow the safety regulations applying in the laboratory. *ITE 2.18*
10. List at least three components of an assembly line production system which must be monitored. *ITE 5.22*
11. Distinguish between scheduled and unscheduled maintenance of production equipment.

Content Outline	Teacher Plans and Activities
V. Materials and Processing Technology **F. Manufacturing Technology** **5. Processes of Manufacturing** b. Producing the Product (1) Scheduling Production (a) Charts, Sheets, and Diagrams (b) Plant Layouts	Operation sheet, flow process chart, operation process chart, flow diagram: See Wright, Processes of Manufacturing, pp. 416-420.
(2) Designing the Tooling (a) Jigs (b) Fixtures (c) Dies (d) Patterns (e) Gauges (f) Other	
(3) Making the Product (a) Processing Operations (b) Assembling Operations (c) Finishing Operations	Although individual projects or group projects may be used, this lesson lends itself especially well to an assembly line mass production experience in which all members of the class participate as managers, workers, inspectors or observers. The product selected for an assembly line production should include a significant number of industrial processes and materials. It should consist of enough operations so that all students in a given class may participate in a meaningful manner. Individual projects or group projects should be coordinated with those used in Unit 5, Lessons 2 and 3 and should provide a maximum number of new materials and processes. For classes not using an assembly line production format, an appropriate film or video tape may provide an alternate experience. (Wright, Exploring Production, Instructor's Guide, pp. 11-57; Lux, The World of Manufacturing, Laboratory Manual.) The Parke System provides a number of product ideas which may be individually produced and which involve a large number of industrial materials and industrial processes. (Parke, Nelson. Parke's Adventurous Program, Parke System Catalog, 805 S. Devonshire, Springfield, MO. 65802)

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definition of template, die, gauge, operation sheet, flow process chart, operation process chart, and flow diagram; and types of plant layout and types of tooling.	Lux, The World of Manufacturing, Laboratory Manual, pp. 89-107, 152-156, 337-348.
Examine samples of charts and sheets used in scheduling production. Note how the production job was analyzed into operations and how each operation is represented on the chart or sheet by a symbol. Discuss the advantages and disadvantages of using these sheets in scheduling production.	
Prepare a flow process chart for a simple task, such as locating and checking out a library book, clearing the dinner table and washing the dishes, or gathering, washing and putting away laundry.	Bame, Exploring Technology, Activity Manual, pp. 81-83; MAVCC, Exploring Technology Education, pp. ETE-203-D to ETE-205-D.
Complete a chart or sheet which may be used in production of a designated product.	Wright, Exploring Manufacturing, Student Manual, pp. 47-48; Bame, Exploring Technology, Activity Manual, pp. 81-83; Lux, The World of Manufacturing, Laboratory Manual, pp. 89-107, 152-156, 337-348.
Participate in a discussion/demonstration on planning, designing and building jigs and fixtures including a review of measuring.	Gallo, Production Technology, Instructor's Resource Guide, pp. 97-98.
Plan, design and build necessary jigs and fixtures for manufacturing a selected product.	Bame, Exploring Technology, Activity Manual, pp. 87-88.
Visit a manufacturing plant or view a film or video tape showing the manufacturing of a product. Describe the sequence of operations used, tooling used, and type of plant layout used.	"Manufacturing Insights", set of six videos (Lasers In Manufacturing, Automated Inspection/Nondestructive testing, Robots and Surface Preparation, Implementing Just-In-Time, and Machine Vision) from SME Video Communications, One SME Drive, P.O. Box 930, Dearborn, MI 48121; $200 each or $793 for set.
View the necessary demonstrations of processing, assembling and finishing operations needed to manufacture a selected product.	

Content Outline	Teacher Plans and Activities

V. Materials and Processing Technology
  F. Manufacturing Technology
    5. Processes of Manufacturing
      b. Producing the Product
        (4) Monitoring Production
          (a) Labor Efficiency
          (b) Material Quality
          (c) Equipment Efficiency
          (d) Product Quality
          (e) Environment/Safety
          (f) Scheduled Maintenance
          (g) Unscheduled Maintenance
          (h) Manufacturing Records

Suggested Student Activities	References/AV/Supplies/Equipment
View the demonstration, set up a trial run and perform the operation required of an assembly line worker, manager or inspector in manufacturing a selected product.	Bame, Exploring Technology, Activity Manual, pp. 89-90; Heiner, People Create Technology, Activity Manual, pp. 45-47; Todd, Understanding and Using Technology, Activity Manual, pp. 127-134.
Participate in class discussion related to the components of an assembly line production which a manager must monitor, to the maintenance requirements of production equipment and to the student reaction to their assembly line experience.	Wright, Exploring Manufacturing, Student Manual, pp. 51-52, 55, 64-65.
Design a plan to monitor an assembly line production.	Heiner, People Create Technology, Activity Manual, pp. 53-54; Lux, The World of Manufacturing, Laboratory Manual, pp. 118-123, 155-161; APPENDIX B: Sample Record Keeping Forms.
For classes wishing to continue a class enterprise (See Unit V, Lessons 4 and 6), participate in activities related to scheduling production, designing and producing tooling, producing and assembling the selected product, monitoring production and maintaining production records.	Gallo, Production Technology, Instructor's Guide, pp. 67-68; Fales, Technology: Today and Tomorrow, pp. 421-429; Utah, Industrial Arts-Agriculture, "Mass Production".

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 123-130.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 152-176.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 157-170.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 20-22, 93-102.
Hacker, et al., Living With Technology, Delmar, pp. 258.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 205-231.
Heiner, et al., People Create Technology, Davis, 1980, pp. 191.
Heiner, et al., People Create Technology, Teacher's Guide, Davis, 1980, pp. 40-44.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 406-419.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 285-310, 356-389.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 238-241.
Todd, et al., Understanding and Using Technology, Activity Manual, Davis, 1986, pp. 127-134.
Williams, et al., Technology At Work, South-Western, 1987, pp. 173-190.

Selected Readings On Manufacturing

Extension Instruction and Materials Center, Systems of Technology, Laboratory Activities in Production, University of Texas at Austin, 1985, pp. 49-54, 63-68, 215-234, 273-276.
Lux, et al., The World of Manufacturing, Laboratory Manual, McKnight and McKnight, 1971, pp. 122-139, 146-153, 169-174, 396-403, 443-449, 461-465.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp. ETE-1-D to ETE-215-D.
Wright, et al., Exploring Production, Goodheart-Willcox, 1985, pp. 195-202.
Wright, et al., Processes of Manufacturing, Goodheart-Willcox, 1985, pp. 414-443.

Revision Notes:

Lesson Title: Manufacturing--Post-Processing

Unit Scope: This **unit** is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to marketing and servicing of manufactured products.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: maintenance, diagnosis, repair, pallet, skid, marketing, distribution, promotion.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List or select from a list factors which may be considered in developing marketing plans.
4. List the four-step sequence frequently used in advertising.
5. Design the advertising for promoting and selling a specified product. *ITE 3.4*
6. List four purposes which packaging serves.
7. Design the package for containing and promoting a specified product. *ITE 3.4*
8. Describe the phases of distributing products from manufacturer to consumer.
9. Distinguish between wholesale and retail sales.
10. List four factors included in servicing manufactured products. *ITE 5.23*
11. Distinguish between servicing typically required of durable goods and of nondurable goods. *ITE 5.23*

Content Outline | **Teacher Plans and Activities**

V. Materials & Processing Technology
  F. Manufacturing Technology
    5. Processes of Manufacturing
      c. Marketing the Product
        (1) Developing Marketing Plans
          (a) Product
          (b) Price
          (c) Promotion
          (d) Distribution
          (e) Service
          (f) Maintenance
        (2) Advertising the Product
          (a) Attention
          (b) Interest
          (c) Information
          (d) Action
        (3) Packaging the Product
          (a) Contain
          (b) Identify
          (c) Protect
          (d) Display

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in class discussion related to the definition of maintenance, diagnosis, repair, pallet, skid, marketing, distribution, and promotion; and to factors included in developing a marketing plan.	Bame, Exploring Technology, Activity Manual, pp. 91-92; Harms, Manufacturing Technology Activities, pp. 33-37.
Participate in class discussion related to product advertising.	
Collect and examine a variety of advertising materials for their use of the usual four-step sequence.	
Design a poster, brochure or other advertising media to promote the sale of a selected manufactured product.	
Participate in class discussion related to package design.	
Collect unusual packages and analyze each for its effectiveness in containing, identifying, protecting and displaying the product.	
Design a container or package to protect and to promote a selected manufactured product.	Heiner, People Create Technology, Activity Manual, pp. 49-52, 57-58; "Technology Programs: Bellevue, Washington", The Technology Teacher, December 1987, p 28.

Content Outline **Teacher Plans and Activities**

V. Materials & Processing Technology
  F. Manufacturing Technology
    5. Processes of Manufacturing
      c. Marketing the Product
        (4) Distributing and Selling the Product
          (a) Warehousing
          (b) Transporting
          (c) Marketing Wholesale
          (d) Marketing Retail
      d. Servicing the Product
        (1) Installing Product
        (2) Maintaining Product
        (3) Repairing/Replacing Product
        (4) Recycling/Disposing of Product

Suggested Student Activities	References/AV/Supplies/Equipment
Participate in a class discussion related to distributing and selling manufactured products.	
Participate in a class discussion related to products which require special installation, calling attention to the special installation requirements of each product; related to products that require regular maintenance, calling attention to the type and frequency of maintenance required; related to examples of products where repair involves the replacement of a sub-assembly rather than an individual piece; and related to products which may be recycled to serve a second function.	Bame, Exploring Technology, Activity Manual, pp. 15-21; Heiner, People Create Technology, Activity Guide, pp. 107-110; APPENDIX B: Sample Record Keeping Forms.
Visit a retail store or participate in a class discussion with a guest speaker from a retail store on the topic of methods of calculating cost, profit and selling price.	APPENDIX B: Sample Record Keeping Forms.
Establish the cost, percentage of profit and selling price for a selected product manufactured by mass production.	
For classes wishing to establish a class enterprise, participate in activities related to developing a marketing plan, packaging, advertising, distributing and selling, and servicing a product. (See Unit V Lessons 4 and 5)	Fales, Technology: Today and Tomorrow, pp. 421-429; Heiner, People Create Technology, Teacher's Manual, pp. 40-43.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 121-123, 130-134.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 152-176.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 170-172.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, p. 64-71.
Hacker, et al., Living With Technology, Delmar, 1988, pp. 245, 361-365.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 219-221.
Heiner, et al., People Create Technology, Davis, 1980, pp. 110-112, 133-136, 140.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 12, 364-365, 410-412.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 307-310.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 241-243, 290-291.
Williams, et al., Technology At Work, South-Western, 1987, pp. 224-227.

Selected Readings On Manufacturing

Extension Instruction and Materials Center, Systems of Technology, Laboratory Activities in Production, University of Texas at Austin, 1985, pp. 41-43, 45, 47, 73-75, 77-78, 235, 237-242.
Lux, et al., The World of Manufacturing, McKnight & McKnight, 1971, pp. 404-415, 478-483.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp. ETE-181-D to ETE-215-D.
Wright, et al., Exploring Production, Goodheart-Willcox, 1985, pp. 215-250.
Wright, et al., Exploring Production, Student Manual, Goodheart-Willcox, 1985, pp. 57-63.
Wright, et al., Exploring Production, Instructor's Guide, Goodheart-Willcox, 1985, pp. 44-47.

Revision Notes:

Lesson Title: Constructing--Pre-Processing

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to types of structures, legal responsibilities in construction, selected construction resources, and planning the construction project.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: contractor, developer, base line, principal meridians, elevation, restrictive covenants, bench mark, building codes, contracts, mechanics lien, liability, guarantee.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish among residential, commercial and industrial buildings.
4. Identify at least three pathways constructed for transportation systems. *ITE 5.3*
5. Identify at least three types of bridges constructed for transportation systems.
6. List or select from a list the services which may be classified as utilities.
7. Identify at least three different types of distribution and collection systems for utilities.
8. Distinguish among section, township and range as used in legal land description.
9. Describe the meaning of a given land description which uses metes and bounds terminology.
10. Match major categories of building materials used in construction with their uses.
11. Distinguish among heavy equipment, light equipment, portable power equipment and hand tools. *ITE 5.16*
12. List two construction occupations for each of the professional, management and labor categories. *ITE 2.14*
13. Match each process involved in designing a project with its definition or description. *ITE 3.13*
14. List at least four factors that need to be controlled in the construction process.
15. Give at least two reasons why job safety is important to both the company and the worker.

Content Outline **Teacher Plans and Activities**

- V. Materials & Processing Technology
  - G Construction Technology
    - 1. Types of Structures
      - a. Buildings
        - (1) Residential Buildings
        - (2) Commercial Buildings
        - (3) Industrial Buildings
      - b. Transportation Systems
        - (1) Pathways
        - (2) Bridges
        - (3) Tunnels
      - c. Utility Systems
        - (1) Physical Plants
        - (2) Distribution/Collection Network
      - d. Special Structures
        - (1) Pneumatic Structures
        - (2) Space Structures
        - (3) Manufactured Housing
        - (4) Other
    - 2. Establishing a Construction Enterprise
      - a. Organizing an Enterprise
      - b. Financing an Enterprise
    - 3. Legal Responsibilities in Construction
      - a. Legal Land Description
        - (1) Metes and Bounds
        - (2) U.S. Public Land Survey
        - (3) Lot and Block
        - (4) State Plane Coordinate
      - b. Zoning Laws
        - (1) Major City Zones
          - (a) Single Family
          - (b) Multiple Family
          - (c) General Shopping
          - (d) Commercial
          - (e) Light Industrial
          - (f) Heavy Industrial
        - (2) Structural Restrictions
          - (a) Minimum Lot Size
          - (b) Maximum Building Size Per Lot
          - (c) Maximum Building Height
          - (d) Minimum Floor Space
          - (e) Other
      - c. Building Codes
      - d. Contracts
      - e. Mechanics Lien
      - f. Liability
      - g. Guarantee
      - h. Environment
      - i. Other

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in class discussion related to the definitions in competency #1; and to types of structures.	
View a film related to construction, such as building of the Gateway Arch, etc.	
Develop a bulletin board display showing models, photos or drawings of structures.	
Write a research paper of approximately three pages (1) on an historical aspect of building, bridge, road, or utility system construction, such as materials used in road construction throughout history; (2) on a specific structure, such as the Gateway Arch, Eads Bridge, Golden Gate Bridge, Hoover Dam, Panama Canal, Kansas City International Airport, Astrodome, Alaskan pipeline, Vehicular Assembly Building at Cape Canavaral, etc.; (3) on a construction topic, such as suspension bridges, geodesic domes, undersea tunnels, missile silos, Roman roads, aqueducts, farm irrigation system in the West, corduroy roads, etc.; or (4) on special types of construction such as, pneumatic, space, manufactured, high rise, etc..	Harms, Construction Technology Activities, pp. 12-20, 36-40; Utah, Industrial Arts-Agriculture, "High Rise Living Units".
Participate in a class discussion related to legal land description and on a survey map observe the section, township and range in which the school is located.	
Interpret the meaning of: beginning at a concrete and bronze monument located 27.8 feet north and 35.3 feet west of the center lines of Johnson Avenue and 10th Street of the town of Construction , County of Technology, State of Missouri, thence S 10° 12' W for a distance 87.3', thence due west 64.0' to a steel pin.	Bame, Exploring Technology, Activity Manual, pp. 103-105; Lux, The World of Construction, Laboratory Manual, pp. 10-14.
Participate in class discussion related to zoning laws, obtain copies of zoning laws and/or building codes which pertain to the local community, and identify those which applied to the building of the school.	
Participate in class discussion related to building contracts, mechanics lien, liability, guarantees and environment as legal aspects of construction.	

Content Outline	Teacher Plans and Activities

V. Materials & Processing Technology

- **G. Construction Technology**
  - 4. Selected Construction Resources
    - a. Materials
      - (1) Concrete/Masonry
      - (2) Wood
      - (3) Metal
      - (4) Glass
      - (5) Other
    - b. Machines and Tools
      - (1) Heavy Equipment
      - (2) Light Equipment
      - (3) Portable Power Equipment
      - (4) Hand Tools
    - c. Human
      - (1) Professional
      - (2) Management
      - (3) Labor
      - (4) Other
    - d. Capital
    - e. Time
  - 5. Processes of Construction
    - a. Planning the Project
      - (1) Designing the Project
        - (a) Identifying the Needs
        - (b) Completing Feasibility Studies
        - (c) Preparing Design Solution
        - (d) Completing Drawings
        - (e) Writing Specifications
        - (f) Adding Design Changes
      - (2) Analyzing Project Needs
        - (a) Scope of the Project
        - (b) Completion Date
        - (c) Project Bids
      - (3) Contracting for Resources
        - (a) Materials
        - (b) Equipment
        - (c) Employees
      - (4) Establishing Control Systems
        - (a) Project Inspection
        - (b) Material Inspection
        - (c) Labor Standards
        - (d) Equipment Rates
      - (5) Establishing Safety Systems
        - (a) Education
        - (b) Encouragement
        - (c) Enforcement
        - (d) Equipment
        - (e) Engineering

Suggested Student Activities	References/AV/Supplies/Equipment
With the people living in your home discuss any contracts they have, such as with employers, unions, insurance companies, credit card companies, rental agents, etc., and report to the class some of the stipulated terms.	Henak, Exploring Construction, pp. 102.
Participate in class discussion related to construction materials; construction machines and tools; and human, capital and time resources in construction.	APPENDIX B: Sample Record Keeping Forms
Participate in a field trip to a lumber yard/ building supply dealer or in a guest lecture by a building supply representative related to construction materials.	
Research construction catalogs for special tools used in construction and identify their purpose; or participate in a presentation by a construction employee related to construction tools.	
Complete worksheets matching construction materials with their use; and matching names with illustrations of construction equipment.	Bame, Exploring Technology, Activity Manual, pp. 93-94; Wright, Exploring Production, Student Manual, pp. 85-86; MAVCC, Exploring Technology Education, pp. ETE-31-C to ETE-150-C.
Participate in class discussion related to designing a construction project.	
Write a two page description of a family for whom you wish to sketch a residence, describing their activities and interests, and sketch on graph paper a first floor plan of a home to meet their needs. (See Unit V Lesson 8)	Lindbeck, General Industry and Technology, pp. 95; Harms, Construction Technology Activities, pp. 4-11.
For classes wishing to construct a full-size structure or corner assembly, design a small building and participate in activities in drawing, planning, costing and ordering materials, scheduling and monitoring the project. (See Unit V Lessons 8 and 9)	Lux, The World of Construction, Laboratory Manual, pp. 26-89, 102-108; Wright, Exploring Production, Instructor's Guide, pp. 60-70.
Participate in a class presentation by an architect or contractor related to the sequence of steps required in planning, bidding, contracting, building and inspecting for the construction of a residence or commercial building.	
Participate in class discussion related to the factors which must be controlled in a construction project and in establishing a construction safety plan.	

Content Outline **Teacher Plans and Activities**

V. Materials & Processing Technology
  G. Construction Technology
    5. Processes of Construction
      a. Planning the Project
        (6) Planning the Site
          (a) Selecting Site
          (b) Obtaining Site
          (c) Surveying Site
        (7) Preparing To Build
          (a) Obtaining Building Permits
          (b) Laying Out Planned Structure
          (c) Obtaining Utilities
          (d) Maintaining Site Safety/ Security

Suggested Student Activities	**References/AV/Supplies/Equipment**
Participate in a class discussion related to planning the site and preparing to build.	
Participate in a presentation by a guest speaker, such as a contractor showing a site before and after construction, a surveyor describing the surveying process, a city building inspector describing building permits, etc.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 143-159.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 152-176.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 79-110.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, p. 72-82.
Hacker, et al., Living With Technology, Delmar, pp. 285-314.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 233-257.
Heiner, et al., People Create Technology, Davis, 1980, pp. 42-43, 192.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, p. 308-312.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 147-173.
Williams, et al., Technology At Work, South-Western, 1987, pp. 236-261.

Selected Readings On Constructing

Feirer, et al., Production Technology, Bennett and McKnight, 1986, pp. 386-412.
Henak, Exploring Construction, Goodheart-Willcox, 1985, pp. 7-138.
Lux, et al., The World of Construction, McKnight and McKnight, 1970, pp. 45-52, 60-124, 133-151.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp. ETE-1-C to ETE -183-C.

Revision Notes:

Lesson Title: Constructing--Processing

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to clearing and preparing a construction site, building a foundation and support structure, and installing systems for residential, commercial and industrial buildings; pathways, bridges, and tunnels of transportation systems; and physical plants and distribution or collection networks of utility systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: rafter, stud, joist, modular unit, prefabrication, frostline, receptacles, conduit, circuit breaker, junction boxes, HVAC, vapor barrier.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. List five methods used for clearing a construction site.
4. Describe the importance of testing the soil prior to construction.
5. Distinguish among the types of foundations.
6. Mix, slump test, and finish concrete. *ITE 5.11, 5.14*
7. Distinguish among the types of support structures.
8. Match a list of structural terms with the appropriate parts shown on photos or models of a floor frame, wall frame, and roof frame of a structure.
9. Construct a full-size or model structure. *ITE 2.18, 5.11, 5.13 , 5.15 , 5.22*
10. Identify the three main components of a completed roof structure.
11. Identify four elements of the environment which are controlled by the use of insulation.
12. Categorize a list of construction subsystems by its appropriate system. *ITE 5.3*
13. Plan the systems needed for a structure. *ITE 1.2*
14. Design and wire a doorbell circuit and a lighting circuit. *ITE 1.2, 1.8, 3.4, 3.20*
15. Follow in all laboratory activities the safety regulations applying in the laboratory. *ITE 2.18*

- **V. Materials & Processing Technology**
  - **G. Construction Technology**
    - **5. Processes of Construction**
      - b. Building the Structure
        - (1) Scheduling Construction
          - (a) Bar Chart Method
          - (b) Critical Path Method
        - (2) Clearing the Site
          - (a) Wrecking
          - (b) Breaking
          - (c) Blasting
          - (d) Salvaging
          - (e) Moving
        - (3) Doing the Earthwork
          - (a) Testing Soil
          - (b) Excavating Soil
          - (c) Finishing Earthwork
        - (4) Building the Foundation
          - (a) Slab
          - (b) Footing
          - (c) Pile/Pier
        - (5) Building the Support Structure
          - (a) Mass Structure
          - (b) Bearing Wall Structure
          - (c) Framed Structure
          - (d) Pneumatic Structure
          - (e) Space Structure
      - c. Enclosing the Exterior
        - (1) Roof
          - (a) Deck
          - (b) Flashing
          - (c) Roofing
          - (d) Insulation
        - (2) Walls
          - (a) Masonry/Curtain Walls
          - (b) Insulation
          - (c) Siding
        - (3) Doors and Windows

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to definitions in competency #1, charts used in scheduling construction, methods for clearing construction sites, and purposes of testing soil.	
Participate in small group activity to perform a specific soil test.	Lux, The World of Construction, Laboratory Manual, pp. 21-25.
Participate in a class discussion related to foundations and types of support structures.	Harms, Construction Technology Activities, pp. 17-20, 29-35; Utah, Industrial Arts-Agriculture, pp. "Pneumatic Structures", "Space Structures".
Mix and finish concrete and perform a slump test.	Texas, Systems of Technology, Laboratory Activities in Production, pp. 97-98; Lux, The World of Construction, Laboratory Manual, pp. 133-141; Bame, Exploring Technology, Activity Manual, pp. 95-96; MAVCC, Exploring Technology Education, ETE-113-C to ETE-129-C.
Participate in a class discussion related to roofs, walls, doors and windows. Examine construction materials used for roofs, walls, doors and windows.	
Complete a worksheet recording the construction methods and materials used for a selected building or home.	
Draw and/or build a model of a transportation system structure, or a utility system structure.	Gallo, Production Technology, Instructor's Resource Guide, pp. 79-81; Fales, Technology: Today and Tomorrow, pp. 406-420; Hacker, Living With Technology, pp. 346-347; Wright, Exploring Production, Instructor's Guide, pp. 81-110.

Content Outline	Teacher Plans and Activities

V. Materials & Processing Technology
  G. Construction Technology
    5. Processes of Construction
      d. Installing Systems
        (1) Transportation Systems
          (a) Stairways/Escalators
          (b) Elevators
          (c) Conveyors
          (d) Chutes
          (e) Dumbwaiters
          (f) Pneumatic Tubes
        (2) Climate Control Systems
          (a) Temperature Control
          (b) Moisture Control
          (c) Pollution Control
        (3) Plumbing Systems
          (a) Water
          (b) Fuel
          (c) Waste
        (4) Electrical Power Systems
          (a) Residential
          (b) Commercial
          (c) Industrial
        (5) Communication Systems
          (a) Monitor
          (b) Exchange

Suggested Student Activities	References/AV/Supplies/Equipment
Design and build a model truss structure following specified guidelines. The activity may be competitive or noncompetitive and may involve destructive testing of the models.	Todd, Understanding and Using Technology, pp. 83-96; Texas, Systems of Technology/Production, pp. 255-261; Gallo, Production Technology, Instructor's Guide, pp. 80; Utah, Industrial Arts-Agriculture, Truss Construction, pp. 1-15, Platform Design, pp. 1-9; Harms, Construction Technology Activities, pp. 21-28; Fales, Technology: Today and Tomorrow, pp. 400-405, 416-420; Hacker, Living With Technology, pp. 308-313.
Complete a worksheet of a wall, floor, and roof section, matching names with the features.	Bame, Exploring Technology, Activity Manual, pp. 97-98.
Participate in a class discussion related to the systems needed in a typical structure.	Lux, The World of Construction, Laboratory Manual, pp. 175-201.
Design and wire doorbell and lighting circuits.	Hacker, Living With Technology, pp. 348-349; Bame, Exploring Technology, Activity Manual, pp. 63-66, 99-101.
For the home planned for the family described in Unit V Lesson 7, describe the climate of the building location, and plan the building systems needed to construct this home.	
For classes wishing to construct a full-size structure or corner assembly, participate in activities related to building the structure, enclosing the exterior and in stalling the systems. (See Unit V Lessons 7 and 9)	Lux, The World of Construction, Laboratory Manual, pp. 157-256; Wright, Exploring Production, Instructor's Guide, pp. 81-110.
For classes wishing to construct a model, participate in activities related to the design and construction of a model home.	Goetsch, Technology and You, pp. 110.
For classes wishing to construct housing or feeders for birds or other animals, design and construct a bird house, a bird feeder, a dog house or similar structure for a specific species of bird or a specific animal.	"Back Yard Birds" and Woodworking For Wildlife from Missouri Department of Conservation (free); Hylton, William H., ed., Build It Better Yourself, 1977, Rodale Press, Emmaus, PA 18049, pp. 290-311.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 143-173.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 152-176.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 103-106.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 72-82.
Hacker, et al., Living With Technology, Delmar, pp. 294-297, 315-345.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 243-245.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 313-325.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 250-260.
Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 147-173.
Williams, et al., Technology At Work, South-Western, 1987, pp. 236-261.

Selected Readings On Constructing

Henak, Exploring Construction, Goodheart-Willcox, 1985, pp. 141-249.
Lux, et al., The World of Construction, McKnight and McKnight, 1970, pp. 168-358.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp. ETE-1-C to ETE -183-C.

Revision Notes:

Lesson Title: Constructing--Post-Processing

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to interior finishing, exterior finishing and landscaping, transferring responsibilities, and servicing and maintaining structures and sites for residential, commercial and industrial buildings; pathways, bridges, and tunnels of transportation systems; and physical plants and distribution or collection networks of utility systems.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: lath, furring strip, mastic, mill work, subfloor, caulking.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Distinguish among three types of walls: load bearing, nonload bearing, and partitions.
4. Distinguish among the aspects of finishing a structure: painting, decorating, trimming, caulking, covering floors, and installing equipment, fixtures and furniture.
5. Distinguish between fixtures and furnishings.
6. Identify at least four fixtures or accessories which are permanently installed in structures.
7. Identify at least three purposes for exterior finishes.
8. Prepare for and apply a finish to a structure.
9. List types of accesses required for various construction projects.
10. List at least five jobs which are included in landscaping a construction site. *ITE 5.13*
11. Identify five groups of people who are concerned with inspecting construction projects.
12. List three methods of protecting a completed structure and site.
13. Match maintenance tasks with the frequency of need.
14. Identify ways that the value of a structure and site may be increased by altering it, installing new equipment and/or restoring it.
15. Follow in all laboratory activities the safety regulations applying in the laboratory. *ITE 2.18*

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Content Outline	Teacher Plans and Activities

- **V. Materials & Processing Technology**
  - **G. Construction Technology**
    - **5. Processes of Construction**
      - e. Completing the Project
        - (1) Enclosing Interior
          - (a) Ceilings
          - (b) Walls
          - (c) Floors
        - (2) Finishing
          - (a) Painting
          - (b) Decorating
          - (c) Trimming
          - (d) Caulking
          - (e) Covering Floors
          - (f) Installing Equipment/ Fixtures/Furniture
        - (3) Constructing Accesses
        - (4) Landscaping
      - f. Transferring the Project
        - (1) Final Inspection
        - (2) Closing the Contract
          - (a) Approvals
          - (b) Releases
          - (c) Warranties and Manuals
        - (3) Final Payment
    - 6. Servicing/Maintaining the Structure
      - a. Protecting
        - (1) Fences
        - (2) Patrols
        - (3) Monitoring Devices
        - (4) Chains and Locks
      - b. Maintaining
        - (1) Scheduled
        - (2) Unscheduled
      - c. Repairing/Replacing
      - d. Altering/Installing
      - e. Recycling/Disposing

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook material related to each concept introduced.	
Participate in a class discussion related to the definitions: lath, furring strip, mastic, mill work, subfloor, and caulking.	
Participate in a class discussion related to enclosing the interior, finishing, constructing accesses and landscaping.	
Prepare for and apply finish coat of paint to an item, such as a room at home, a fence, a board for a bookshelf, a full-size structure built in class, etc.	
Sketch a scaled plot plan for a specific structure, such as home or school, etc., proposing improved accesses and landscaping with special attention to the needs of disabled people.	
Participate in a class discussion related to transferring the project.	
Participate in a class discussion related to protecting, maintaining, repairing/replacing, altering/installing, and recycling/disposing of the structure and/or the site.	
Participate in a presentation by the school maintenance staff related to the maintenance cycle used for such activities as cleaning, changing light bulbs, landscaping, inspecting utility systems, maintaining accesses, etc. Categorize these tasks as maintenance, repair, or protection.	
Participate in a class presentation by a contractor related to the research, design, planning, cost estimation and special requirements of remodeled and restored structures.	
For classes wishing to construct a full-size structure or corner assembly, participate in activities related to completing the interior, finishing (if appropriate) and transferring the project. (See Unit V Lessons 7 and 8)	Lux, The World of Construction, Laboratory Manual, pp. 231-260.

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 167-169.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 357-362.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 103-106.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, p. 75-77.
Hacker, et al., Living With Technology, Delmar, pp. 332-333.
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, p. 319-323.
Williams, et al., Technology At Work, South-Western, 1987, pp. 248-250.

Selected Readings On Constructing

Henak, Exploring Construction, Goodheart-Willcox, 1985, pp. 250-301.
Lux, et al., The World of Construction, McKnight and McKnight, 1970, pp. 353-409, 505-518.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987, pp. ETE-1-C to ETE -183-C.

Revision Notes:

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Lesson Title: Selected Emerging Areas: Materials & Processing Technology

Unit Scope: This unit is designed to provide students introductory concepts and skills necessary to work in the area of materials and processing technology. It may include the specific applications of the concepts and skills introduced in Unit II. Through this **lesson** each student will learn fundamental concepts and skills related to several significant examples of emerging developments in materials and processing technology.

Selected Competencies. Refer to Core Competencies and Key Skills for Missouri Schools, September 1986, and/or Missouri Industrial Technology Education Guide, 1987.

As a result of the learning experiences planned for this lesson, each student should be able to:

1. Match words with definitions or define: halophyte, automation, mechanization, artificial intelligence, subsidiaries, ergonomics.
2. Begin using the designated vocabulary terms along with the proper names of equipment, materials and processes in classroom and informal conversations.
3. Recognize that technological change is continuous, has an effect on humans, and is brought about by human action; therefore, each individual may assume a responsible role in directing technological change. *ITE 2.19*
4. Identify products that have been developed within the past decade using new materials. *ITE 5.18*
5. List raw materials found on the moon which may be used in manufacturing or constructing. *ITE 5.18*
6. List three changes in food products or in the methods of producing food products which have resulted from recent technology. *ITE 5.18*
7. Describe the meaning of self-sufficient communities, prefabricated structures, flexible use structures, and smart buildings.
8. Give one example each of the use of automation in the processing, controlling, monitoring, materials handling, and storage/retrieval aspects of manufacturing. *ITE 5.18, 5.19, 5.20*
9. Identify at least one use of lasers and of infra-red scanners.
10. Gather pertinent information, formulate and express an opinion related to the human factors of a developing technology. *ITE 2.7, 2.8, 2.19*

Content Outline **Teacher Plans and Activities**

- V. Materials & Processing Technology
  - H. Selected Emerging Areas: Materials and Processing Technology
    - 1. New Materials
      - a. Ultra-Light Metals
      - b. Plastics
      - c. Adhesives
      - d. Food Products
        - (1) Growth Hormones
        - (2) Halophytes (Salt Water Plants)
      - e. Lunar Minerals
    - 2. New Processes
      - a. Construction Techniques
        - (1) Self-Sufficient Communities
        - (2) Prefabricated Structures
        - (3) Flexible Use Structures
        - (4) Smart Buildings
      - b. Automated Manufacturing Systems
        - (1) Automated Processing
          - (a) Fixed Automation
          - (b) Programmable Automation
        - (2) Automated Controlling/Managing/Monitoring
        - (3) Automated Material Handling
          - (a) Machine-to-Machine Devices
          - (b) Machine-Loading Devices
        - (4) Storage/Retrieval Devices
      - c. Production in Space
        - (1) Structures in Space
        - (2) Manufacturing in Space
    - 3. Innovative Tools and Equipment
      - a. Computers
        - (1) Artificial Intelligence
        - (2) Computer Aided Design
      - b. Lasers
      - c. Infra-Red Scanners
    - 4. Trends in Company Ownership
      - a. Subsidiaries
      - b. Foreign Ownership
    - 5. Trends in Human Factors
      - a. Human Life and Health
      - b. Human Factors Engineering
      - c. Human/Environment Interaction
      - d. Ethical Concerns
      - e. Employability/Literacy
      - f. Leisure Time

Suggested Student Activities	References/AV/Supplies/Equipment
Read assigned textbook materials related to each concept introduced.	
Maintain a diary throughout this lesson making entries which reflect individual thoughts and opinions related to how the topics affect the individual, what feelings they have related to the perceived effects, and what related action they might like to take.	
Participate in class discussion related to definition of term in competency #1, as well as new materials and new processes used in industry, in the school and in the home.	
View a film or video tape related to new materials and/or processes, such as "Simulating Space Construction" (ASR/182); "Astronaut Backpack" (ASR/189), "Space Shuttle Tiles" (ASR/176); "Space Colonization" (ASR/137); or "Plant Space Suits" (ASR/206).	"Audio/Visual Catalog", Current Edition, National Aeronautics and Space Administration, Marshall Space Flight Center, Marshall Space Flight Center, AL 35812.
View a film or video tape related to automated manufacturing processes.	
Demonstrate to the class how a selected product represents current manufacturing or construction technology; or describe the findings of an article from a recent periodical related to current manufacturing or construction technology.	
Participate in class discussion related to innovative tools and equipment, to trends in company ownership, and to trends in human factors.	
View a film or video tape related to innovative tools and equipment, such as "Laser Rendezvous and Docking" (ASR/207); "Landsat 4" (ASR/210); "Offshore Radar Computers"; etc.	"Audio/Visual Catalog", Current Edition, National Aeronautics and Space Administration, Marshall Space Flight Center, Marshall Space Flight Center, AL 35812.
Participate in class discussion led by a person in the community concerned with human factors related to new materials and processes, such as a medical doctor who deals with life support systems; a designer or engineer who develops furniture to fit humans; a psychologist who works with people unemployed due to new technology; or a representative from a mental health center or hospital who provides information about stress management and leisure time.	

Evaluation (Cognitive, Affective, Psychomotor)

It is suggested that student attainment of the stated **cognitive** competencies of this lesson be evaluated using written or oral test items as well as participation in classroom discussion and activities.

Similarly the **psychomotor** competencies of this lesson may be evaluated primarily by observing the student's participation in and completion of the activities planned for this lesson. A skill test related to the suggested tools and machines could also be used in evaluating the psychomotor competencies. A safety test is recommended for each student on each tool or machine following a demonstration and preceding the use of the equipment in the classroom.

The evaluation of the **affective** competencies of this lesson is largely a subjective process involving the observation of the interaction between the individual and the classroom environment. Certain observable responses of the individual tend to indicate the degree to which related competencies are attained. In many cases it would be helpful for the teacher to designate prior to the evaluation those responses which may indirectly indicate the competency.

Selected Reading References

Bame, et al., Exploring Technology, Davis, 1980, pp. 257-267, 269-284.
Fales, et al., Technology: Today and Tomorrow, Glencoe, 1988, pp. 133-135, 149-160, 187-199, 388-399.
Goetsch, et al., Technology and You, Delmar, 1987, pp. 160-170, 413-433.
Groneman, et al., General Industrial Education and Technology, McGraw-Hill, 1986, pp. 29-48, 54-72, 493-497.
Hacker, et al., Living With Technology, Delmar, pp. 269-273, 483-509.
Hacker, et al., Technology In Your World, Delmar, 1987, pp. 221-229, 293-324, 360-386.
Heiner, et al., People Create Technology, Davis, 1980, pp. 229-246
Lindbeck, et al., General Industry and Technology, Bennett and McKnight, 1986, pp. 21-45.
Minton, et al., Teaching Technology To Children, Davis, 1987, pp. 261-265, 282-285, 311-314.
Williams, et al., Technology At Work, South-Western, 1987, pp. 190-192, 322-324, 352-433.

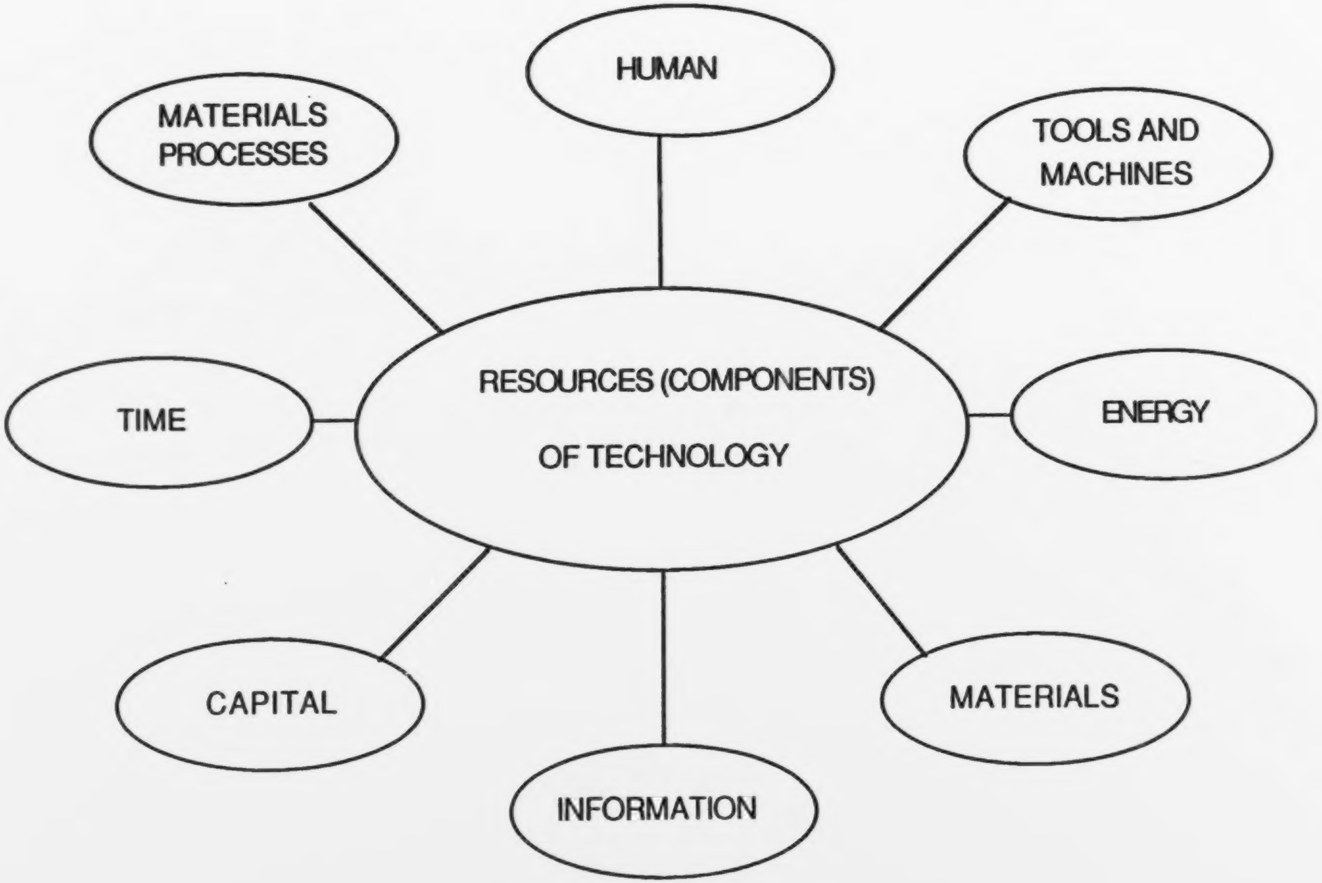
Selected Readings On Materials and Processing Technology

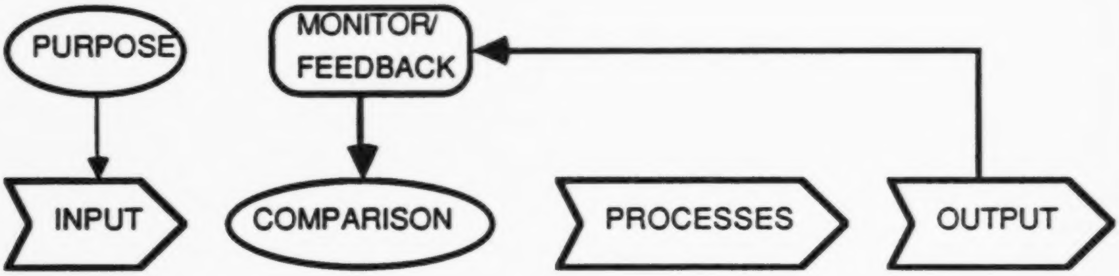
Lux, et al., The World of Manufacturing, McKnight and McKnight, 1971, pp. 129-134.
Mid-America Vocational Curriculum Consortium, Exploring Technology Education, MAVCC, 1987.
Wright, et al., Exploring Production, Goodheart-Willcox, 1985, pp. 530-535.
Wright, Processes of Manufacturing, Goodheart-Willcox, 1987, pp. 421-438.

Selected Educational Resources

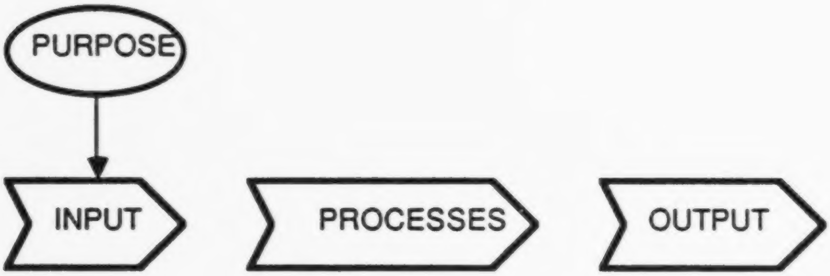
National Aeronautics and Space Administration, Marshall Space Flight Center, AL 35812
"NASA Educational Publications" (PAM-101/7-87)
"The Next Step: Large Space Structures" (NF-129)
"Living In Space", Book II (Levels D, E, F) (EP-223)
"Living and Working in Space: A History of Skylab" (SP-4208)
"Audio/Visual Catalog", Current Edition

Most issues of Popular Science will show new developments in material and processing technology.


HUMAN
MATERIALS PROCESSES
TOOLS AND MACHINES
TIME
RESOURCES (COMPONENTS) OF TECHNOLOGY
ENERGY
CAPITAL
MATERIALS
INFORMATION


PURPOSE
MONITOR/
FEEDBACK
INPUT
COMPARISON
PROCESSES
OUTPUT

CLOSED-LOOP SYSTEM MODEL

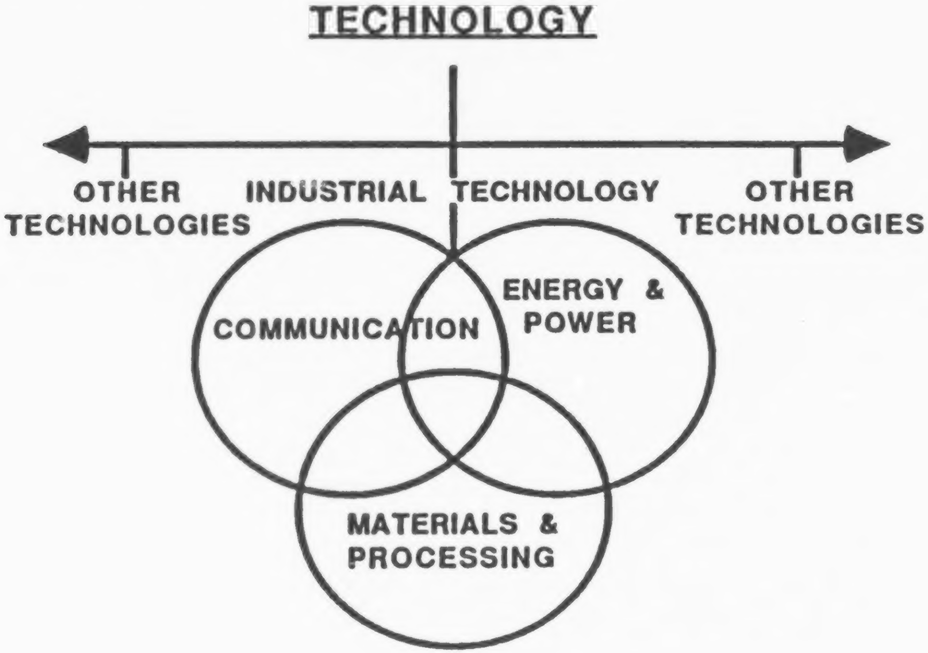

PURPOSE
INPUT
PROCESSES
OUTPUT

OPEN-LOOP SYSTEM MODEL

HUMAN SENSORY PERCEPTION

SIGHT	(Optical, Vision, Visible)
HEARING	(Audio, Audible)
SMELL	(Olfactory)
TASTE	(Gustatory)
TOUCH	(Tactile, Kinesthetic)

Relationship of Technology to Industrial Technology


TECHNOLOGY
OTHER TECHNOLOGIES
INDUSTRIAL TECHNOLOGY
OTHER TECHNOLOGIES
COMMUNICATION
ENERGY & POWER
MATERIALS & PROCESSING

MEASURING DEVICES

ASSIGNMENT: Locate measuring devices and tell where you found them.

TIME

- SUNDIAL
- HOURGLASS
- CHRONOMETER
- CLOCK
- STOVE TIMER
- EGG TIMER
- WASHER/DRYER TIMER
- PARKING METER

TEMPERATURE

- COLOR OF METAL
- PYROMETRIC CONE
- PYROMETER
- CANDY THERMOMETER
- PURPLE RING (WOOD BURNER)
- CAR TEMPERATURE GAUGE

AREA

- PLANIMETER

VOLUME

- SYRINGE

LENGTH

- MEASURING WHEEL
- DEPTH GAUGE
- SQUARE FRAMING
- YARDSTICK
- SCALE
- RULE
- METER STICK
- COMPASS
- DIVIDERS
- CALIPERS
- MARKING GAUGE
- FEELER GAUGE
- LINE GAUGE
- ZIG ZAG RULE
- STEEL TAPE
- MICROMETER
- BROWN AND SHARP GAUGE
- UNITED STATES STANDARD GAUGE

ANGLE

- PROTRACTOR
- SLIDING T-BEVEL

MASS

- BALANCE BEAM
- WEIGHT SCALES (DOCTOR)
- POSTAL SCALE
- TRUCK SCALE

PRESSURE

- GAS
- WATER
- (CAR) TIRE AIR GAUGE
- PRESSURE TANK GAUGE
- OXYGEN TANK GAUGE
- BLOOD PRESSURE CUFF

MISCELLANEOUS

- BRINELL HARDNESS TESTER
- ROCKWELL HARDNESS TESTER
- RICHTER SCALE--SEISMOGRAPH
- BAROMETER
- ANEMOMETER
- BATTERY TESTER (HYGROMETER)
- AUDIOLOGY TESTER
- TACHISTOSCOPE
- ELECTROENCEPHALOGRAM
- DYNAMOMETER
- SCREW PITCH GAUGE

SIZE

- RING GAUGE
- SHOE GAUGE

VERTICAL/HORIZONTAL/ PERPENDICULAR

- SURVEYOR'S LEVEL
- T-SQUARE
- TRY SQUARE
- PLUMB BOB
- PLUMB LINE
- CARPENTER'S LEVEL

QUANTITIES

- KWH METER
- WATER METER
- GASOLINE GAUGE (CAR)
- GAS GAUGE (STATION)
- VOLTMETER
- AMMETER
- OHMMETER

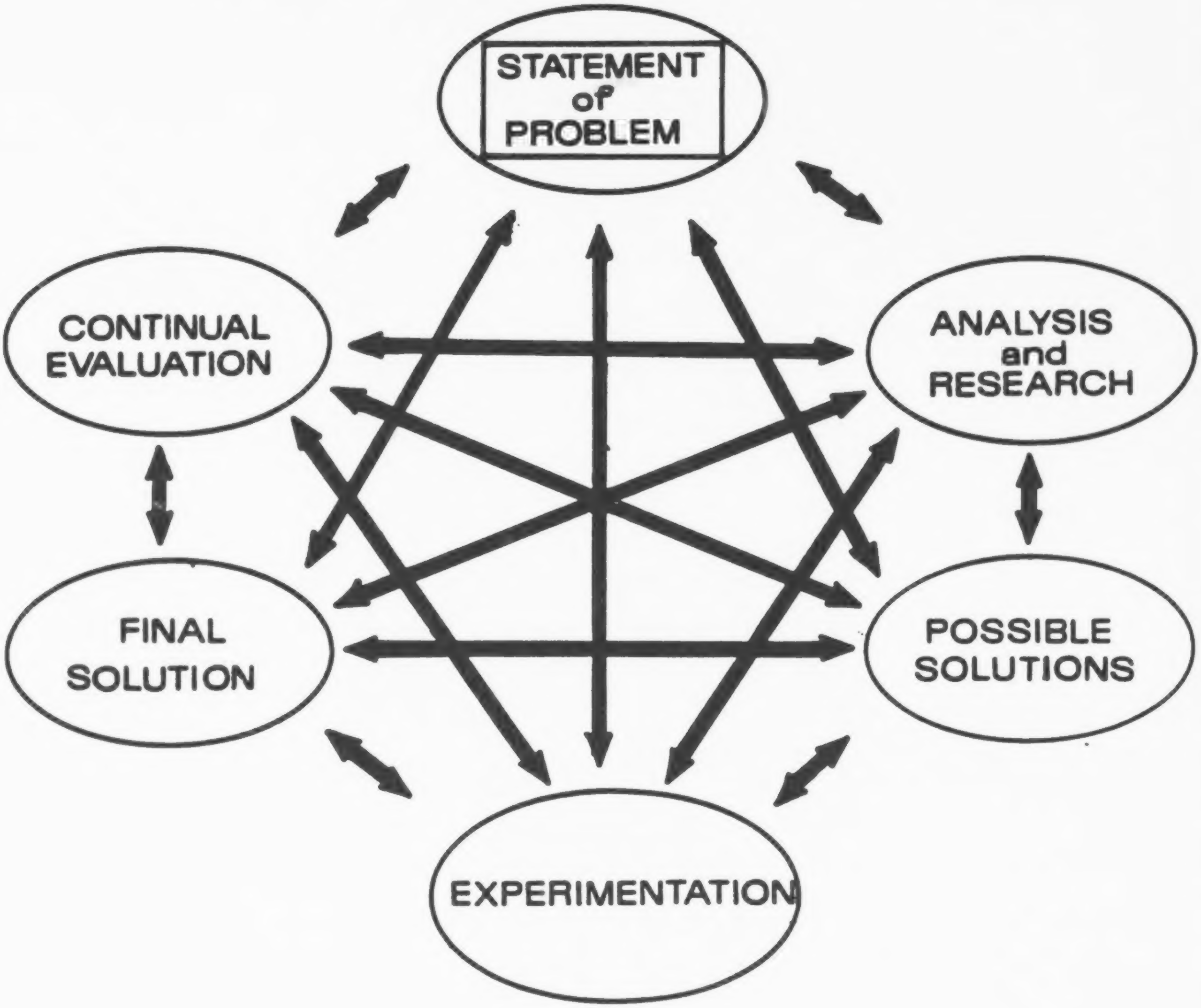
UNITS OF MEASUREMENT

DIRECTIONS: For each of the following units of measurement identify one application.

CUBIT
FATHOM
FOOT
DIGIT
FURLONG
CHAIN
ROD
HAND
PICA
POINT
LIGHT YEAR
SPAN
LEAGUE
PACE
NAUTICAL MILE
STATUTE MILE
ROOD
BOLT
ELL
LINK
AGATE
CABLE
MIL
CALORIE
KNOT
REAM
DOZEN
CASE
GROSS
ANGSTROM
VOLT
AMPERE
OHM
WATT
NEWTON
NEWTON-METER
JOULE
PASCAL
GRAM
HERTZ
MOLE
CANDELA
METER
ACRE

SQUARE FEET
ROOD
FLUID OUNCE
GILL
PINT
QUART
GALLON
DROP
DRAM
JIGGER
FLAGON
FIRKIN
BARREL
HOGSHEAD
PIPE
TUN
TEASPOON
TABLESPOON
CUP
PINT
QUART
BUSHEL
PECK
GALLON
TON
CORD (WOOD)
RICK
HORSEPOWER
FOOT CANDLE
FOOT POUNDS
POUNDS/SQUARE INCH
DEGREES CELSIUS
DEGREES KELVIN
DEGREES FAHRENHEIT
SECOND
MINUTE
HOUR
WEEK
YEAR
TROY OUNCE
BOARD FEET
BRITISH THERMAL UNIT
SQUARE CENTIMETERS
LITERS (CUBIC DECIMETER)

DESIGN ANALYSIS METHOD


STATEMENT of PROBLEM
CONTINUAL EVALUATION
ANALYSIS and RESEARCH
FINAL SOLUTION
POSSIBLE SOLUTIONS
EXPERIMENTATION

APPLICATION OF DESIGN ANALYSIS PROCESS

Although this format indicates a step-be-step procedure while the design process is cyclic, the use of a logical format leads to a systematic approach to solving design problems. Do not look for solutions until you reach Part IV.

I. STATEMENT OF THE PROBLEM: In one concise sentence, indicate the basic function which the article is to serve. Be specific. If you want many possible solutions, state the problem broadly; if you want limited solutions, state the problem in more detail. Example: "To design a device which will hold 15 books in an orderly, upright position" will give more possibilities than "to design a bookcase to hold 15 books."

II. DESIGN PARAMETERS, CRITERIA, OR REQUIREMENTS AND LIMITATIONS: Don't search for solutions until all requirements are identified and specified. This may be one or two lists stating what the product must accomplish and must not allow. If you make two lists, (1) the requirements should list those criteria which your solution must meet—such things as proposed life-span; ease of operation, installation, cleaning, and maintenance; resistance to heat, stain, or moisture; legal requirements, customer demands, safety requirements, performance requirement; for whom it is designed--and (2) the limitations should list all factors which restrict your solution--such as size restrictions; material or construction limits; human factors or standard sizes; color, style, or finish limitations; cost range; weight or size restrictions; temperature, humidity, or dust restrictions; strength requirements; time required to produce; legal and safety restrictions. Do not impose unnecessary restrictions.

III. RESEARCH: This should include information concerning (1) competitor's solutions, how others have solved this or a similar problem. Entries may be in the form of sketches, cut-outs pasted to the sheet, patent search data, or ideas from related products. Sources should be documented by placing the name of the author or publisher, title, date, and page number near each item.

This section would also include any (2) standard size data, (3) applicable laws or regulations, (4) feasibility studies, and (5) marketing research information--need for the product and opinions regarding preferred solutions. Write a descriptive statement of research which cannot be shown pictorially. Also identify attempts to locate information which proved to be unsuccessful. Explain how all research relates to the problem.

IV. TENTATIVE SOLUTIONS: Break the total problem in various sub-parts and generate ideas for solving each sub-part—like materials, shapes, holding devices, hinging devices or finishes. Get a maximum number of ideas, partial solutions, or variations. Be sure all solutions and ideas are recorded. A minimum of five sketches of tentative solutions to your design should be shown.

After obtaining all tentative solutions, evaluate them—outlining their good points and weaknesses--based on the design criteria in part II.

V. FINAL SOLUTION: From all of your tentative solutions, select the one or combine parts from several which best meet the design criteria. Sketch orthographic, pictorial or schematic views as needed to describe the product. Add notes and a descriptive paragraph explaining how it works.

VI. EVALUATE FINAL SOLUTION: Using the design criteria identified in part II, tell how well your final solution meets each criterion. If your solution fails to meet some criteria, identify what may be done to overcome these shortcomings. Does your final solution adequately meet the listed criteria?

FORMAL TECHNIQUES TO DEVELOP DIVERGENT THINKING

These may be used individually or in combination

I. Brainstorming

A. Developed by Alex F. Osborn, founder of Creative Education Foundation.
B. Purpose is to increase ideation of a group -- good for large volume of alternatives or novel design approaches.
C. Basic Rules
   1. Defer judgment. No criticism during ideation phase -- evaluate as later stage.
   2. Freewheeling is welcome. The wilder the ideas the better.
   3. Qualtity is desirable. The more ideas the better; quantity brings quality.
   4. Combine and improve. Hitchhiking sparks related thoughts toward the problem.
   5. Record all ideas.
D. Often involves 6-12 participants; leader polices the ground rules and facilitates the process.

II. Checklists

A. Developed by Alex F. Osborn.
B. Purpose is to chang the mental set whereby one may increase the breadth and complete range of ideas by referring to a list of idea-spurring questions.
C. His list:
   1. PUT TO OTHER USES? New ways to use as is? Other uses if modified?
   2. ADAPT? What else is like this? What other ideas does this suggest?
   3. MODIFY? Change meaning, color, motion, sound, odor, taste, form, shape? Other changes?
   4. MAGNIFY? What to add? Greater frequency? Stronger? Larger? Plus ingredient? Multiply?
   5. MINIFY? What to subtract? Eliminate? Smaller? Lighter? Slower? Split up? Less Frequent?
   6. SUBSTITUTE? Who else instead? What else instead? Other place? Other time?
   7. REARRANGE? Other layout? Other sequence? Change pace?
   8. REVERSE? Opposite? Turn it backward? Turn it upside down? Turn it inside out?
   9. COMBINE? How about a blend, an assortment? Combine purpose? Combine ideas?
D. Hill's List.
   1. What's wrong with it?
   2. How can it be improved?
   3. Modify?
   4. Magnify?

VI. Synectics.

- A. Developed by William JJ Gordon.
- B. Purpose is to provide a problem solving process which will increase analogous ideas of a group -- good for developing radically new idea, developing new products, or improving products -- often produces a few unique ideas.
- C. Involves 4-7 participants with diverse backgrounds; one must be an expert in the problem field; another is the leader. Leader records ideas and guides group along the steps of the process -- doesn't contribute ideas.
- D. Key operation is the transformation of the real problem to a hypothetical one in a different environment or world. If problem is organic (biology, native customs, personal feelings), the new world is inorganic (engineering, geology, chemistry).
- E. Steps -- all sessions are tape recorded.
  1. Leader defines problem.
  2. Non-expert participants explore preliminary ideas; the expert's critique (purge) is given; valuable suggestions are recorded.
  3. Each participant formulates an idealized solution to the problem.
  4. The leader selects an idealized solution and asks for transformation to specified new "World". Any ideas may be transformed into still another world.
  5. After the group explores analogous problems through transformations, the leader asks for ideas (force fit) to the real problem. This may be repeated with other idealized solutions or entire cycle may be repeated with a new leader.

VII. Design Analysis Process.

- A. Used by John R. Lindbeck.
- B. Purpose is to provide sequential framework or outline for solving problems; especially useful when dealing with designing objects or products.
- C. Usual steps include:
  1. Statement of the problem.
  2. Analysis (establish functional requirements, parameters, design criteria) and research (identify what is presently known about the problem).
  3. Possible tentative solutions.
  4. Experimentation.
  5. Final Solution .

5. Minify?
6. Adapt?
7. Other uses?
8. Reverse?
9. New look?
10. Old looks?
11. Rearrange?
12. Substitute?
13. Combine?
14. Convenience?
15. Safety?

III. Attribute Listing or Analysis.

- A. Developed by Robert C. Crawford.
- B. Purpose is to break problem into components or sub problems and to deal with each sub part separately. (good for improving products)
- C. Basic idea is to analyze a problem for its attributes (qualities) and generate ideas for improvement of each attribute -- positive strategy of using what it already posesses.
- D. May be used with checklisting and forced relationships.
- E. Properties listing -- similarly identifies modifiable properties or qualities of design which may be changed or eliminated.

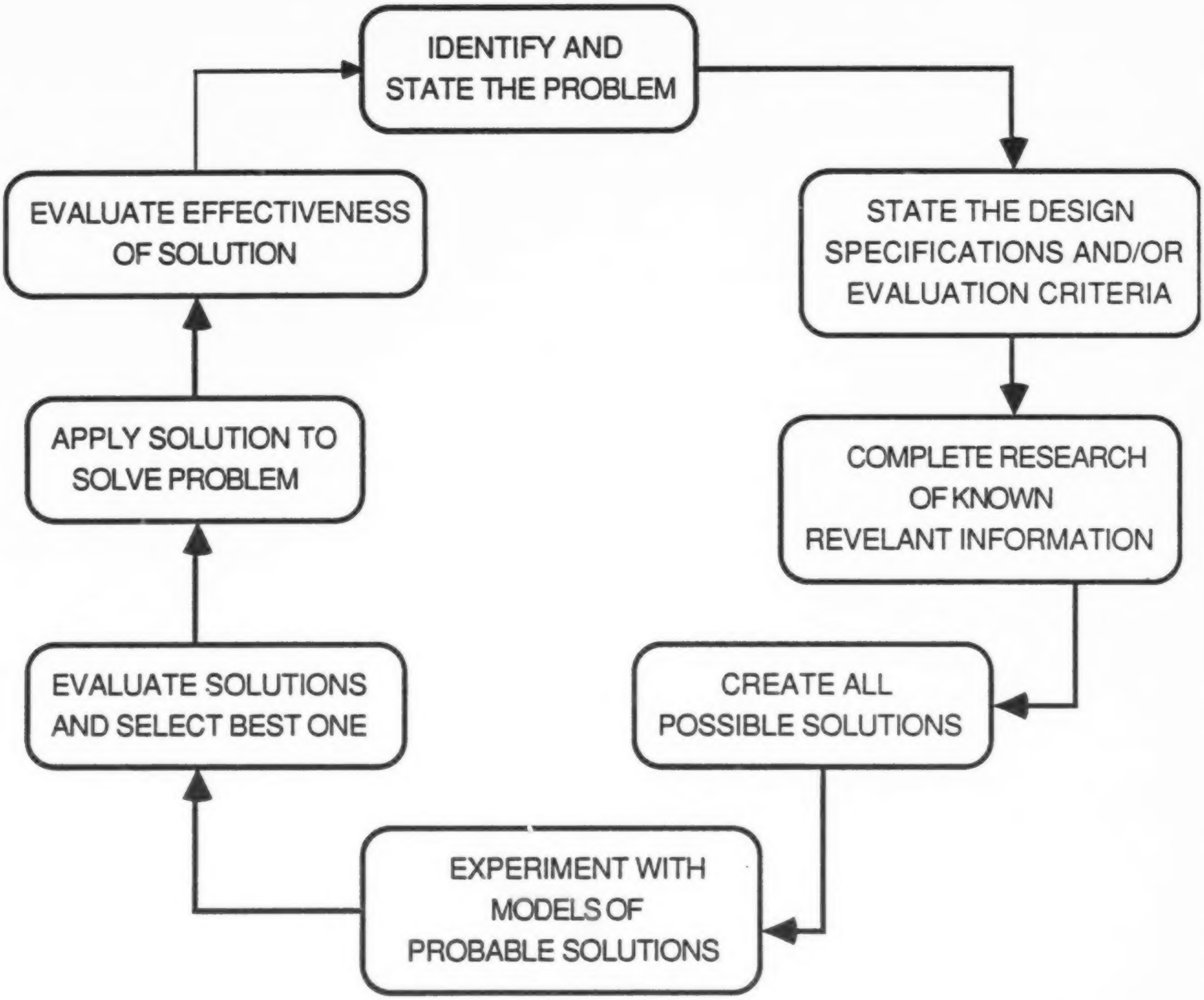
IV. Forced Relationships.

- A. Developed by Charles S. Whiting.
- B. Purpose is to make associations between normally unrelated objects or ideas.
- C. May use matrix of subdivisions in two categories or aspects of an object or situation to observe new conjunctions; may take anything in our awareness (use all senses) and relate it to problem at hand.
- D. Bionics is study of living things as engineering prototypes (radar, velcro, airplane, etc.)
- E. Adaptation is application of solution to a similar problem in another field; must see analogy (pistol grip on electric drill.)
- F. Involvement - useful with mechanical devices - imagine yourself as part of the mechanism.

V. Morphological Synthesis approach; orderly creative inventing; Matrix Analysis.

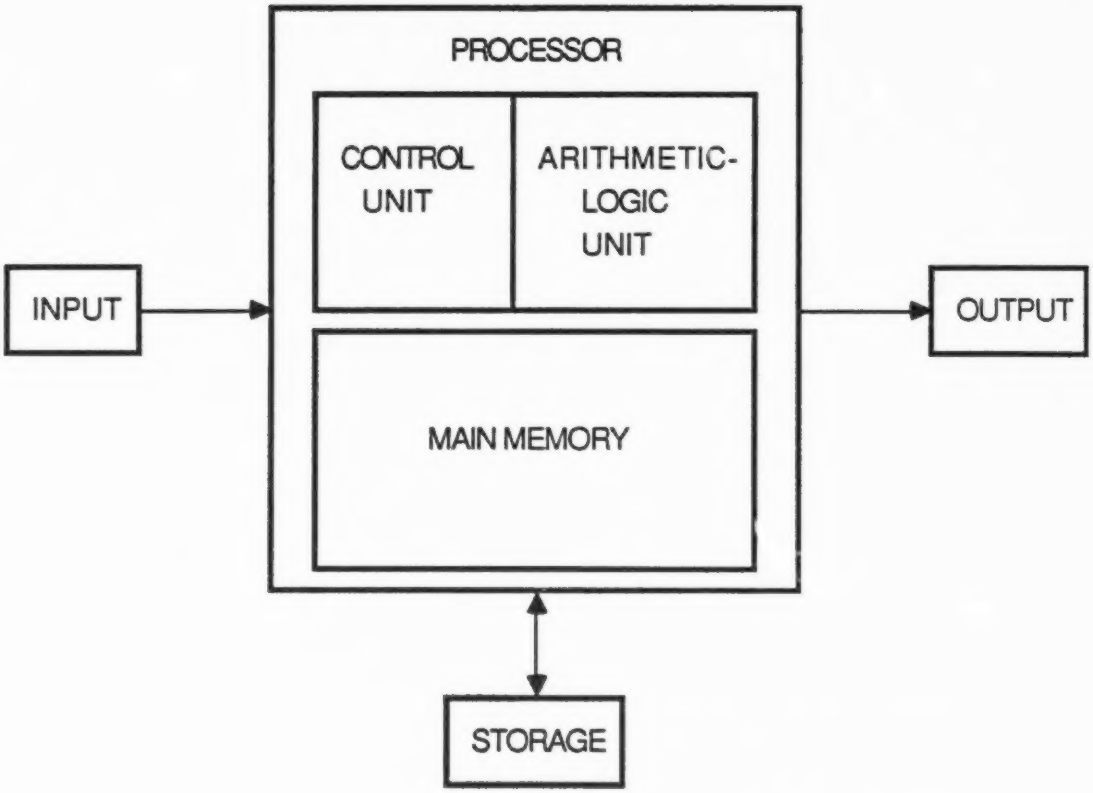
- A. Work by Myron S. Allen.
- B. Purpose is to approach the problem from a logical organization of ideas, rather than intuition and experience -- best for individual effort -- emphasizes description of functional requirements rather than descriptive adjectives --tries to generate new connections.
- C. Method.
  1. Define problem.
  2. Gather information.
  3. Divide the system into subunits.
  4. Describe each subunit by a complete list of its functional requirements.
  5. List all the ways each functional requirement of each subunit can be realized.
  6. Study all combinations of these partial solutions.
- D. May use idea matrix or idea diagram--outline problem into most detailed diagram possible.

THE TECHNOLOGICAL METHOD


IDENTIFY AND STATE THE PROBLEM
STATE THE DESIGN SPECIFICATIONS AND/OR EVALUATION CRITERIA
COMPLETE RESEARCH OF KNOWN REVELANT INFORMATION
CREATE ALL POSSIBLE SOLUTIONS
EXPERIMENT WITH MODELS OF PROBABLE SOLUTIONS
EVALUATE SOLUTIONS AND SELECT BEST ONE
APPLY SOLUTION TO SOLVE PROBLEM
EVALUATE EFFECTIVENESS OF SOLUTION

COMPUTER SYSTEM COMPONENTS

CENTRAL PROCESSING UNIT


PROCESSOR
CONTROL UNIT
ARITHMETIC-LOGIC UNIT
INPUT
OUTPUT
MAIN MEMORY
STORAGE

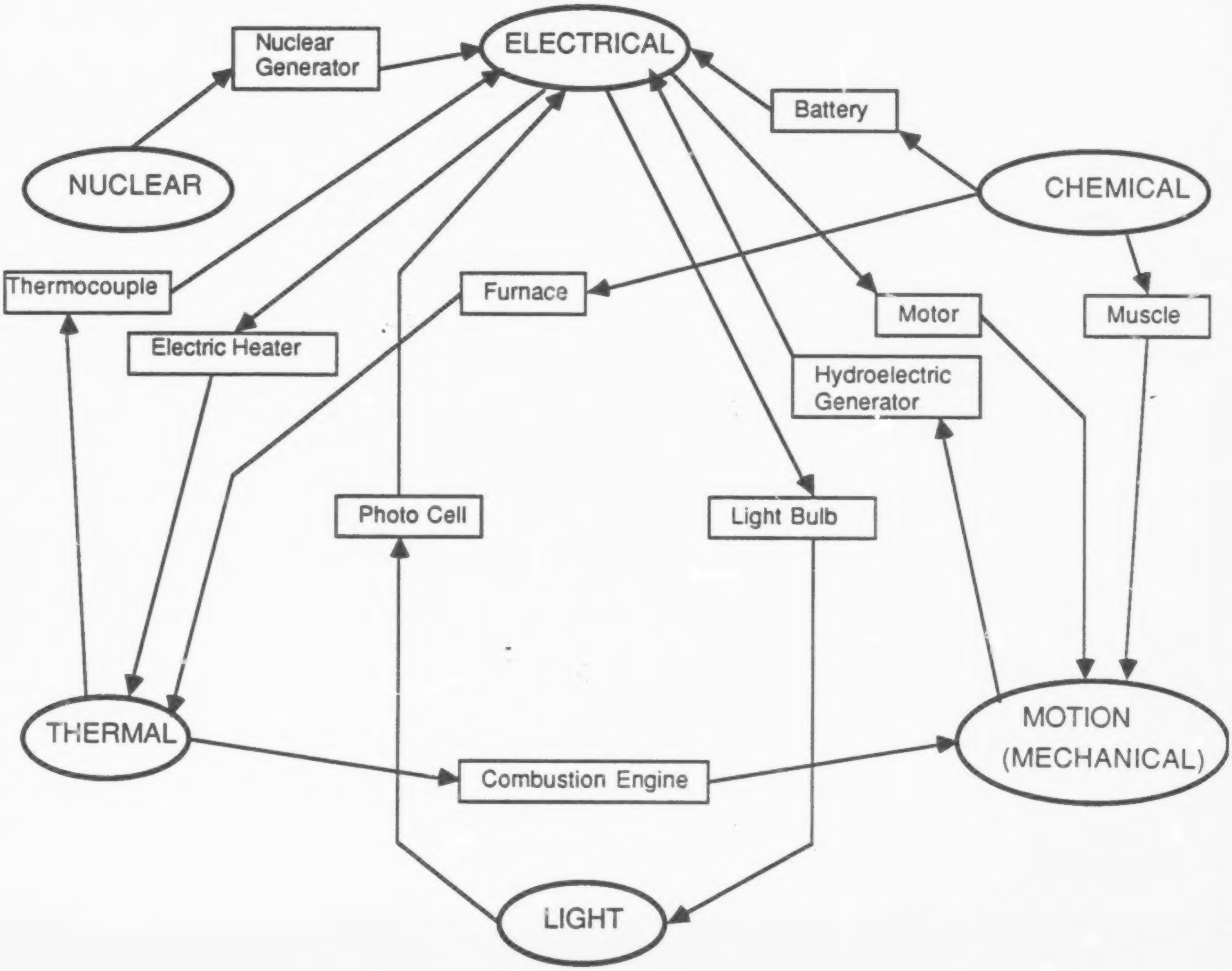
Adapted from: An Introduction to Computers and Information Systems
by Robert A. Rademacher and Harry L. Gibson, South-Western Publishing Co., 1983.

COMPUTER GENERATIONS

	First	Second	Third	Fourth
Time Frame	1951-58	1959-64	1965-74	1975-present
Circuit component	Vacuum Tube	Transistor	Silicon chip [integrated circuit (IC)]	Silicon chip [large-scale integrated circuit (LSI)]
Elements per component	1	1	1-1,000	100-500,000
Internal storage	Magnetic drum	Magnetic cores	Cores, IC	Integrated circuits
Memory capacity (characters)	4,000	32,000	128,000	100 million
Popular computers	IBM 650 Univac 1 Burroughs 220	IBM 1401 CDC 3600 GE 635	IBM 360 Honeywell 200 NCR Century	IBM 303X Univac 6000

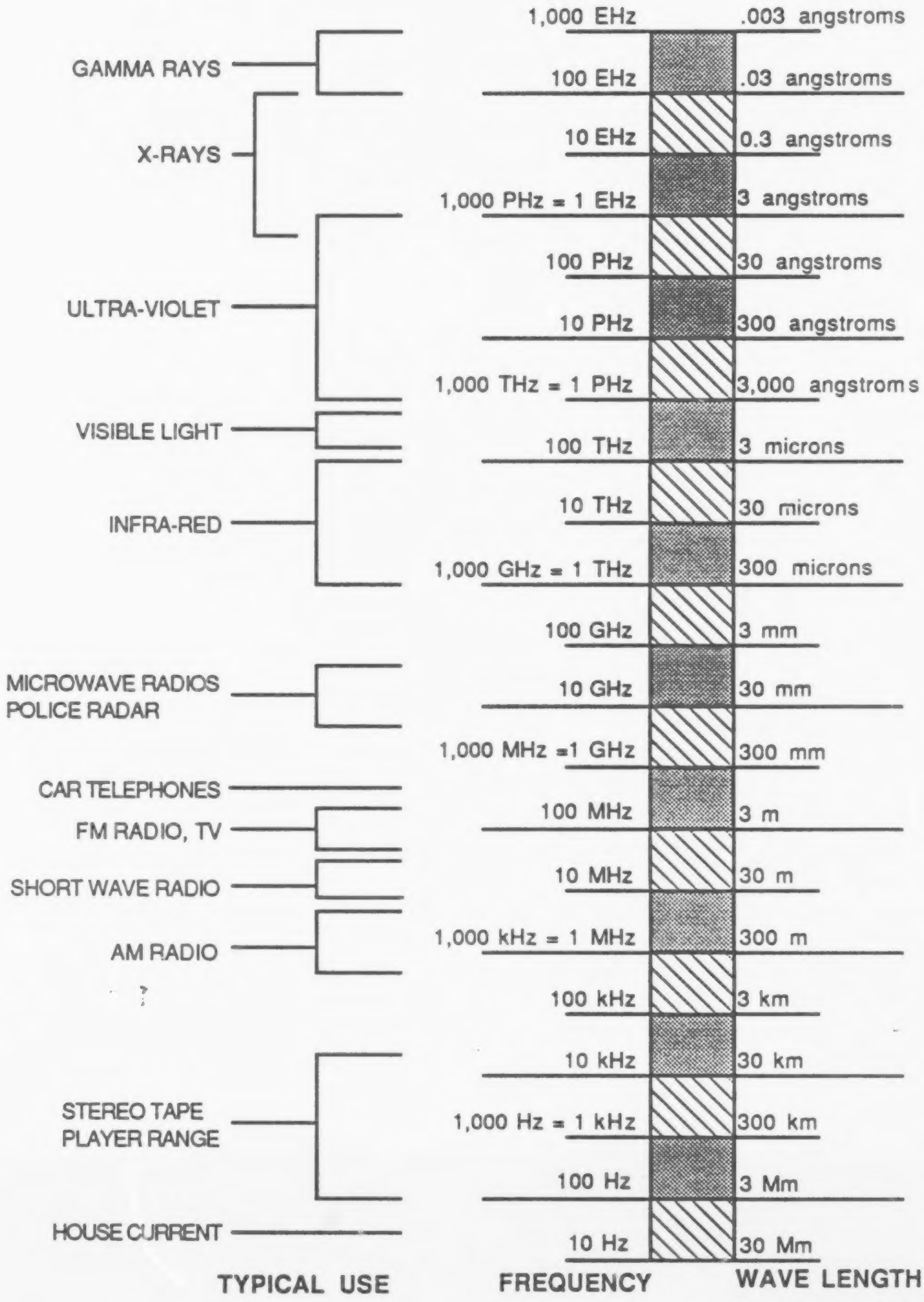
Adapted from: An Introduction to Computers and Information Systems by Robert A. Rademacher and Harry L. Gibson, South-Western Publishing Company, 1983.

TYPICAL ENERGY CONVERTERS


Nuclear Generator
ELECTRICAL
Battery
NUCLEAR
CHEMICAL
Thermocouple
Furnace
Motor
Muscle
Electric Heater
Hydroelectric Generator
Photo Cell
Light Bulb
THERMAL
Combustion Engine
MOTION (MECHANICAL)
LIGHT

370

THE ELECTROMAGNETIC SPECTRUM

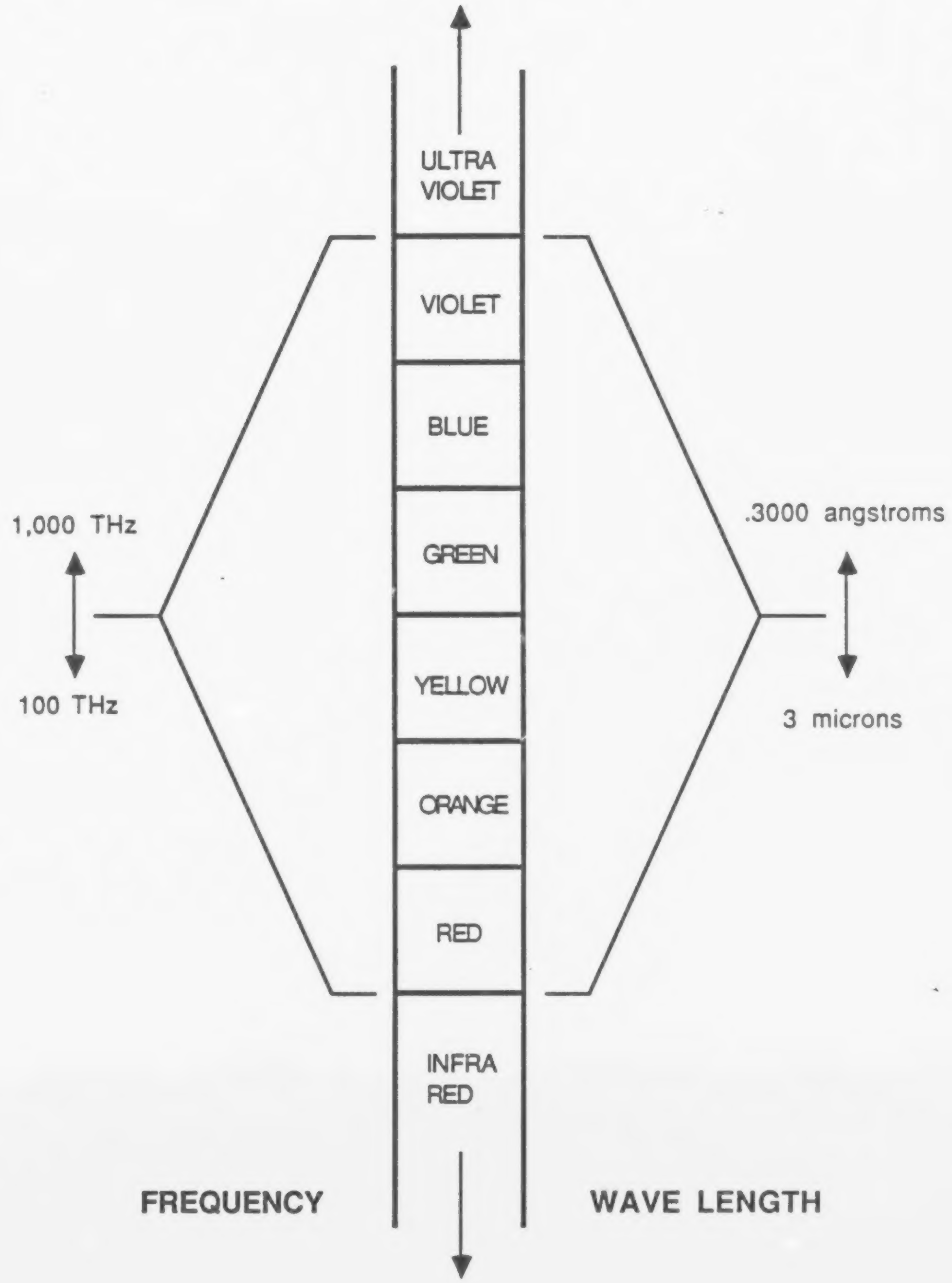

1,000 EHz
.003 angstroms
GAMMA RAYS
100 EHz
.03 angstroms
X-RAYS
10 EHz
0.3 angstroms
1,000 PHz = 1 EHz
3 angstroms
100 PHz
30 angstroms
ULTRA-VIOLET
10 PHz
300 angstroms
1,000 THz = 1 PHz
3,000 angstroms
VISIBLE LIGHT
100 THz
3 microns
INFRA-RED
10 THz
30 microns
1,000 GHz = 1 THz
300 microns
100 GHz
3 mm
MICROWAVE RADIOS
POLICE RADAR
10 GHz
30 mm
1,000 MHz =1 GHz
300 mm
CAR TELEPHONES
100 MHz
3 m
FM RADIO, TV
SHORT WAVE RADIO
10 MHz
30 m
AM RADIO
1,000 kHz = 1 MHz
300 m
100 kHz
3 km
10 kHz
30 km
STEREO TAPE
PLAYER RANGE
1,000 Hz = 1 kHz
300 km
100 Hz
3 Mm
HOUSE CURRENT
10 Hz
30 Mm
TYPICAL USE
FREQUENCY
WAVE LENGTH

(1 micron = .001mm)

(1 angstrom = .0001 micron)

Adapted from: Living With Technology, by Michael Hacker and Robert Barden, Delmar Publishers, 1988.

VISIBLE LIGHT SPECTRUM


ULTRA VIOLET
VIOLET
BLUE
GREEN
YELLOW
ORANGE
RED
INFRA RED
1,000 THz
100 THz
.3000 angstroms
3 microns
FREQUENCY
WAVE LENGTH

CREATIVE RESOURCE ACTIVITY

PURPOSE: To simulate a production setting with several groups, which possess varying amounts of the resources of technology, creatively competing to produce selected products in specific quantities.

GOAL: To use available resources creatively to produce specified quantities of selected products with total value greater and with timing faster than competing groups.

1. Assign students to groups with unequal resources, such as:
    Group 1 - Long on humans, short on capital.
    Group 2 - Long on capital, short on tools.
    Group 3 - Long on space, short on materials.
    Group 4 - Long on materials, short on know-how.
    Group 5 - Long on know-how, short on humans.
    Group 6 - Long on tools, short on space.

2. Products to be produced for retailer (all products in a group are similar).
    A. Fifty name tags, rectangular, 2" x 3", green paper, with method to fasten to clothes, sold at $1.00 each.
    B. Ten Christmas tree decorations, 1" red paper circles centered on 3" green circles, sold at negotiable price.
    C. Three Rattles, head at least 1" x 2" and handle at least 4" long, choice of rattling material and color, sold at $12.00 each.
    D. Six 30-cm rulers, divided into millimeters, choice of color and materials, sold at $6.00 each.
    E. Four platforms to hold at least three copies of your technology textbook, at least 8" off desktop, sold at $10.00 each.
    F. Twelve half pint milk carton autos, cardboard wheels, sold at $2.50 each.
    G. Four kite kits, according to plans provided, sold at $20.00 each.
    H. Sixteen paper airplanes, according to plans provided, sold at negotiable price.

HINTS:
1. Some ideas distributed to some groups as "know-how".
2. Attempt to sign contract to produce goods at specified price and time.
3. Design and use templates.
4. May negotiate loan from banker (teacher).
5. May start employment agency with excess manpower, fee negotiable.
6. Pay negotiable.
7. Provide plans for kites and planes.
8. May get materials and tools from store.

Some ideas for materials to be placed in kits (amounts vary among groups).

*Newsprint roll
*Markers
*Coffee cup
*Tape
*Rubber cement (no brush, some solidified)
*Scissors
*Eraser
*Pipe cleaners
*Brads
*Stapler
*Play money
*Various kinds of paper
*Safety pins
*Popcorn
*Nuts and bolts
*Paper punch
*Bottle caps
*Buttons
*Popcicle sticks
*Circular metal disks (jigs, templates)
*String
*Glue - Elmers (some too dry)
*Balloons
*Pencils (broken)
*Half pint milk cartons
*Rulers
*Paper clips
*Staples
*Newspapers
*Store coupons
*Straight pins
*Scraps of chalk
*Beans
*Colored pencils
*Wire ties
*Straws
*Paper plates

RULES:

1. Each group decides on products to produce from list.
2. Set up manufacturing firm to produce desired product.
3. When products are completed, sell to retailer (only up to number specified) for price indicated or negotiated.
4. Products to be sold for cash to retailer (teacher) for play cash--cash may be used for purchases as needed: salaries, profit sharing, etc.
5. Be creative in obtaining necessary resources.
6. Excess resources may be sold or traded.
7. At pre-determined time, determine group with most money.
8. Discuss effect of unequal resources within groups and determine which resources were considered most important for each group.

FIREMOUSE

PROBLEM: Design a device utilizing a mousetrap which will put out the flame of a typical birthday candle.

LIMITATIONS:

1. The only source of energy allowed is a standard mousetrap.
2. Must be built using the materials supplied. (If materials are not supplied, a maximum of $1.50 can be spent, including the mousetrap.)
3. The solution must be built individually or by a small group as assigned.
4. The operator may not place the mousetrap closer than 36" to the candle.
5. The mousetrap can be 6" higher or lower than the base of the candle.
6. No part of the device may touch the candle prior to extinguishing the flame.
7. The device has to put out the flame within the limit of the normal candle's life. If the flame goes out of its own accord, the requirements of the problem are not met.

GRADING:

1. If the flame is extinguished on the first attempt.	25 points
2. Three point penalty per attempt after the first try (maximum of 7 tries).	- 3 points
3. Subjective judgment on uniqueness of designs and creative solutions.	1 to 10 points

Adapted from worksheet--source unknown.

LESSON I-2 Word Puzzle

DIRECTIONS: Answer each definition by using the words at the top of the puzzle. The number of words needed for each definition is given in parentheses. Words may be used more than once.

Analysis
Communication
Industrial
Open-loop
Scope
Technology

Automated
Energy
Integrate
Power
Sensor

Closed-loop
Feedback
Materials
Processing
Systems

1. The use of information about the output(s) of a system to modify the process. (1) ____________________
2. A device used to monitor the output of a system. (1) ____________________
3. Systems that use information about the output(s) to affect the process. (1) ____________________systems
4. A system of technologies used in combination to provide products or services to fulfill the needs and wants of mankind. (2) ____________________ systems
5. Range; extent; room or opportunity. (1) ____________________
6. Technology related to activities performed to change raw resources according to a plan. (2) ____________and__________ technology
7. Technology related to sending messages. (1) ____________________technology
8. To bring parts together to make a whole. (1) ____________________
9. Technology related to the use of tools and techniques to harness, convert, and control energy. (2) ____________and__________ technology
10. A self-operating mechanism. (1) ____________________
11. A system that does not use information about the output(s) to affect the process. (1) ____________________system
12. Breaking a system down into its various parts and observing the sub-parts individual and interrelated functions. (2) ____________________

LESSON I-2 Word Puzzle Answer Key

1. FEEDBACK
2. SENSOR
3. CLOSED-LOOP
4. INDUSTRIAL TECHNOLOGY
5. SCOPE
6. MATERIALS / PROCESSING
7. COMMUNICATION
8. INTEGRATE
9. ENERGY / POWER
10. AUTOMATED
11. OPEN-LOOP
12. SYSTEMS ANALYSIS

FORECASTING FUTURE TECHNOLOGY

Worksheet

Instructions: Working as an assigned group of three or four students, select (or be assigned) one of the four suggested methods of forecasting future technology and use it to develop your group forecast related to one of the suggested problems or issues. On a separate sheet, outline your group plan for forecasting and document all steps in arriving at your forecast. Submit your completed documentation and forecast to your instructor. Select a group member to present your forecast to the class.

TREND ANALYSIS/ANALOGIES

Solar energy--using standard data related to sunset and sunrise in your town and the average number of sunny days in January, estimate the number of days and hours an active solar heating unit is likely to operate during January of next year if its automatic switch was activated at 8:30 a.m. and at 4:30 p.m. on January 15, 1987.

DELPHI STUDY

Creative fruit flavors--using a Delphi study, determine the flavor of bubblegum or soda pop most likely to be the favorite of students in your school two years in the future or determine what new fruit-flavored soda pop or fruit newtons would be most popular in your school if you were to develop a new product for the market three years from the present. Design a name for your product and design a recyclable container. (Secondary Exploration of Technology--Industrial Communication Systems, Kansas Curriculum Development Project #26-70-1003, Pittsburg State College, 1973, pp. 96-97)

FUTURE HISTORY/SCENARIOS

Create at least six different scenarios related to:
- -type of energy used in 2100 A. D.
- -mean height of students in your school by 2100 A.D.
- -the need for technology teachers in Missouri in 2000 A.D.

Select the scenario which you consider most likely to be true in the designated year.

MODEL

Create a futures wheel showing possible results if one of the following were true:
- -a skin cream that brings back youth,
- -a shampoo that would grow hair for bald,
- -a new non-alcoholic beer,
- -driving age reduced to age 14 in Missouri,

Create a conceptual model of possible effects if:
- -all fossil fuels were used up by 2000 A.D.
- -chalk is no longer available at schools
- -field goals in football would have varying point value: over 45 yards=4 points and under 25 yards=2 points.

Todd, et al., Understanding and Using Technology, Davis, 1985, pp. 317-334.

"WHEN I'M A GRANDPARENT"

WORKSHEET

INSTRUCTIONS: Gather data related to the age of each of the grandparents of the members of the class and find the average (mean) age of all grandparents. From this, calculate (1) the year when the "average grandparent" was the same age as most members of the present class and (2) the year when most students of the present class will be the same age as the "average grandparent's" present age.

Discuss what technology was in use when grandmother was your age--transportation, communication, farming, home construction, food, medical care, etc. What changes have occurred since that year?

Predict what technology will be like in these same areas of life when you become the same age as the "average grandparent". What changes may you expect?

(Adapted from an activity used successfully by Dan Moppin, Robidioux Middle School, St. Joseph, MO)

APPENDIX B: Lesson I-3--"When I'm A Grandparent" 9

LESSON I-3: Word Puzzle

DIRECTIONS: Answer each definition by using the words at the top of the puzzle. The number of words needed for each definition is given in parentheses. Words may be used more than once.

Analysis
Future
Impact
Line
Personal
Technology

Delphi
High
Intermediate
Low
Scenario
Time

Environmental
History
Level
Model
Study
Trend

1. A method of studying the future by imagining a set of events and the consequences of those events. (1) ____________________
2. A method of studying the future which draws information from opinions of a group of experts. (2) ____________________
3. Using human and animal power as the main energy source to provide goods and services. (3) ____________________
4. The effects upon the land, water, and air created by a technological system, both positive and negative. (2) ____________________
5. The use of computers and other modern technical machines to provide goods and services. (3) ____________________
6. A method of studying the future which allows simulation of what might happen. (1) ____________________
7. A method of studying the future by describing events which led up to an imaginary time in the future. (2) ____________________
8. A method of studying the future by taking samples of similar events and predicting general tendencies. (2) ____________________
9. The use of powered machinery to provide goods and services. (3) ____________________
10. A method of arranging events in their chronological order of occurrence. (2) ____________________
11. The effects upon one's body and mind created by a technological system, both positive and negative. (2) ____________________

LESSON I-3 Word Puzzle Answer Key

1. SCENARIO
2. DELPHI STUDY
3. LOW LEVEL TECHNOLOGY
4. ENVIRONMENTAL IMPACT
5. HIGH LEVEL TECHNOLOGY
6. MODEL
7. FUTURE HISTORY
8. TREND ANALYSIS
9. INTERMEDIATE LEVEL TECHNOLOGY
10. TIME LINE
11. PERSONAL IMPACT

OCCUPATIONAL MEASUREMENT

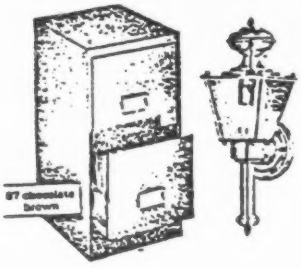
DIRECTIONS: Select an occupation and tell what units of measurement and measuring devices are used in that occupation. Tell the size it represents and how the device was used. Put these findings on a single sheet (both sides) along with a representative drawing or photo. These will be duplicated and the class work reproduced and bound into a booklet. (Make a three minute oral report to class.)

farmer
ready-mix operator
pharmacist
farm real estate agent
meterologist
carpenter
grocery store clerks
railroad engineer
auto mechanic
drafter
cartographer
stevedore or longshoreman
orchard/vineyard farmer (fruit picker)

ship captain
jockey
astronomer
surveyor
machinist
printer
cook
butcher
nurse
electrician
pilot
teacher
clothing manufacturer

FORCED RELATIONSHIPS

Does each pair of objects suggest a third object in which elements of both are combined? Derive as many "third objects" as you can from each pair and draw or write descriptive words for them on a separate sheet. BE ORIGINAL!!!



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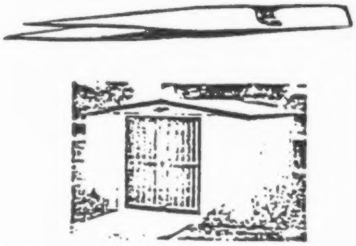

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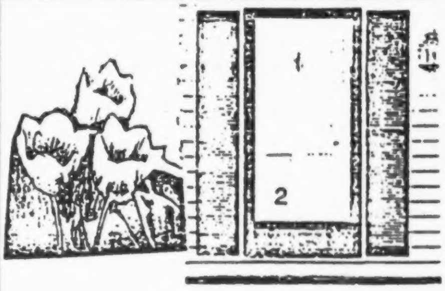

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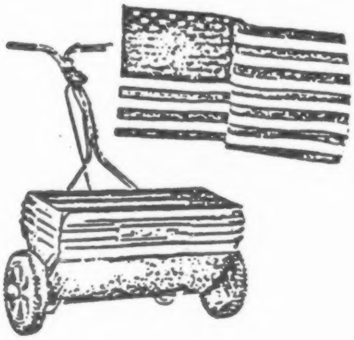

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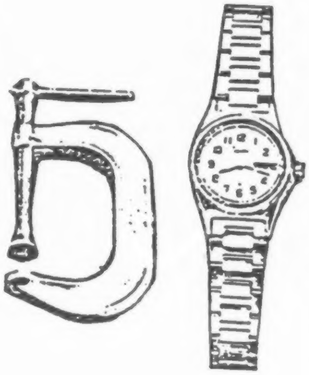

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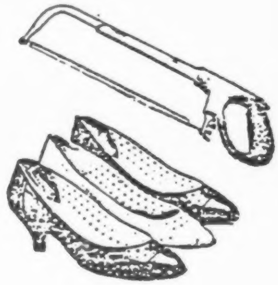

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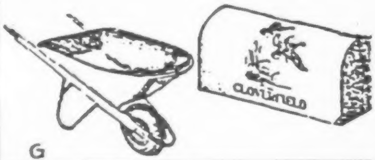

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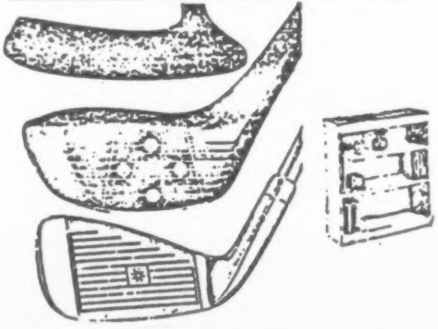

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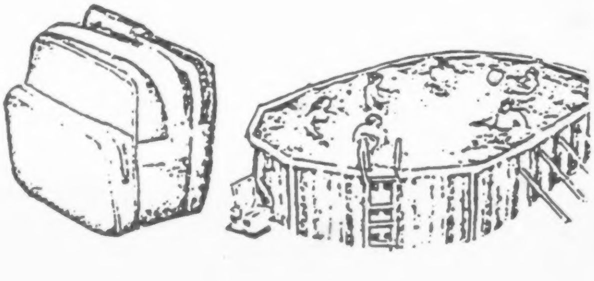


I

ACRONYMS

Acronyms abound in our everyday lives, but we do not always recognize these composite-of-initial-letters for what they are (SNAFU..Situation Normal All Fouled Up). Suppose that many of our everyday words were actually acronyms, formed from the initials of words in descriptive phrases. For example, DOG might be an acronym for Dutiful Obedient Guardian (or Destroyer Of Gardens). TOE might stand for Tip Of Extremity, and BUD might be Blossom Under Development (or Beer Used Daily).

Why not discover some hidden acronyms in your vocabulary? Choose an ordinary word and try to contrive a derivation--a description/definition whose inital letters spell the would-be acronym. I'll accept ten (10), but would prefer to have at least twenty (20). See what you can do. Be crazy, have fun, reach way-y-y-y-y out for your ideas. Challenge yourself. Try some with at least five letters.

ZOO HAIKU

Write a haiku with a zoological twist. Compose your own three line poem according to the following plan:

1. The first line (five syllables) sets the scene, telling where the action takes place.
2. The second line (seven syllables) names an animal and tells what the animal is doing.
3. The third line (five syllables) tells what the animal is wearing.

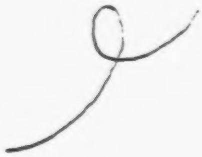
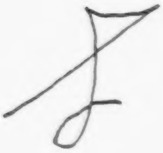
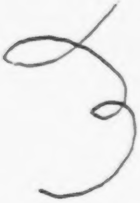
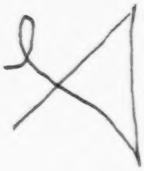
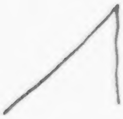
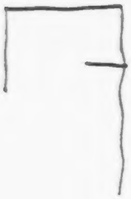
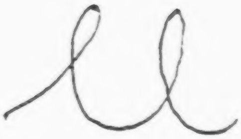
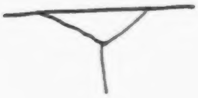
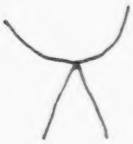
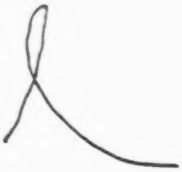
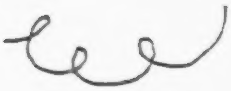
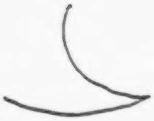
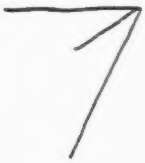
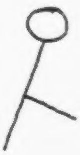
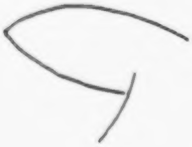
EXAMPLES

Even in the night
Tigers hunt food for their young
In striped pajamas.

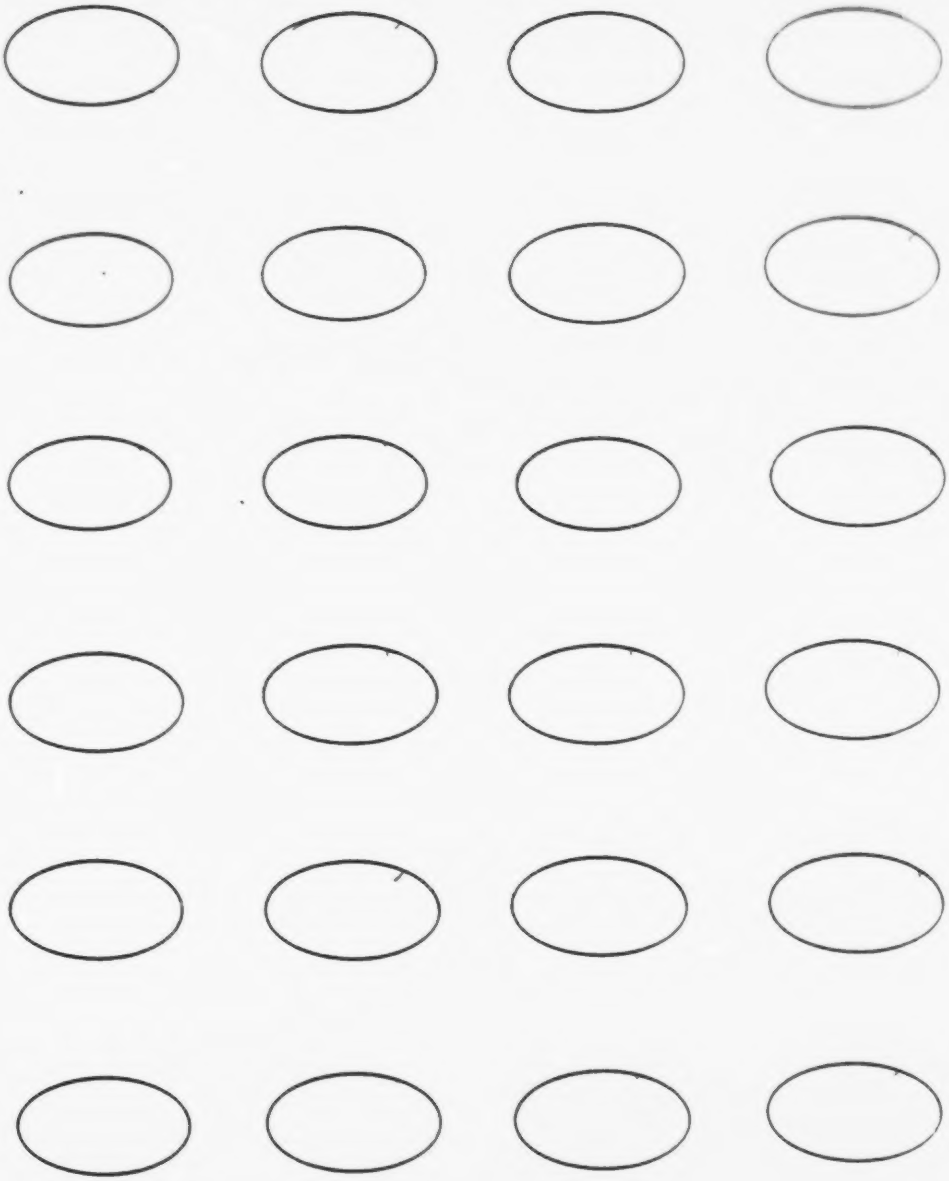
Out in the pasture,
Prancing ponies pirouette;
Velvet coats shining.

See what you can create for our Haiku Zoo. Don't stop with one--let's do at least five. This is an opportunity to let your imagination soar. Visualize.

FUNNY SHAPES

ELLIPSES



GETTING IT ALL TOGETHER

GOAL: Replace crayons in box in a prescribed color arrangement.

1. Divide class into small groups of 4-6 students.
2. For each group, empty six boxes of crayons in the middle of their work table.
3. Allow group to refill the boxes according to a prescribed color arrangement provided by the instructor. Each group times its own work.
4. Discuss with class the needs resulting from group activity, the roles assumed by group members in organizing, and the benefits of group organization.
5. Draw an organizational chart of each group to refine the outcome of the activity.
6. Allow groups to reorganize, to repeat the activity, and to time it again.

Alternate activities could be to:
(a.) Assemble ball point pens
(b.) Assemble pizza ingredients

PAPER AIRPLANE PRODUCTION

GOAL: To produce 20 identical paper airplanes, from idea to final product, in a minimum amount of time.

1. Divide class into groups of six students or less. They are reminded of their past classroom experiences related to group organization. Each group is to be timed for the entire process.

2. Each group should choose a primary criterion for the design of their aircraft.
    *Best aesthetics, the most beautiful craft
    *Best quality of construction
    *Fastest to produce
    *Will fly the farthest
    *Will fly the most consistent path
    *Will fly with some turns

3. Design a variety of airplanes to meet the primary criterion selected and develop prototypes of at least four ideas (five minutes maximum).

4. Test prototypes for meeting primary criterion (five minutes maximum).

5. Organize groups by assigning line-staff responsibilities to produce 20 identical aircraft. Draw organizational chart (ten minutes maximum).

6. Produce 20 identical aircraft (ten minutes maximum).

7. Complete Organization Analysis Worksheet as homework.

8. Entire class discuss reactions to the worksheet.

ORGANIZATIONAL ANALYSIS WORKSHEET

NAME: ______________________________

DIRECTIONS: Based upon your experience in the production of identical paper airplanes, analyze the interaction of your group by responding to the following items:

1. Sketch the organizational structure of your group by indicating both the position title and the name of the individual holding that position. Designate whether positions served staff functions or line functions.

2. Which of the following levels of management and labor where included in your organizational structure?

______	Upper Management	______	Skilled Workers
______	Middle Management	______	Operators
______	Supervisor/Foreman	______	Unskilled Workers

3. How were the leadership positions in your group designated?

   ______ Elected ______ Appointed ______ Spontaneous

4. Did your group have a dominant member?

   ______ No dominant member, all equally involved.
   ______ One person tended to lead throughout the activity.
   ______ More than one person lead at various times.
   ______ Our committee was somewhat ineffective because of lack of leadership.
   ______ Other (explain)

5. Did your group have members who chose not to participate?

   ______ No
   ______ Yes (Explain why this may have occurred.)

6. Were some members of the group greatly influenced by a dominant member?

   ______ No
   ______ Yes (In what way?)

7. Were some members of the group consistently opposed to the suggestions of a dominant member?

   ______ No
   ______ Yes (Give examples.)

8. Were some members of the group effective in clarifying, interpreting, and mediating for the group?

   ______ No
   ______ Yes (Give examples.)

9. Did some members of the group raise questions?

   ______ No
   ______ Yes (Give examples.)

10. Which of these group roles mentioned in items 4 through 9 did you fill?

11. Did you feel your group was effective in meeting its goal? (Explain)

12. Describe the relationship between the organizational structure of your group and the attainment of its goal.

13. How would you change the organizational structure of your group to better meet its goal?

14. Comment on the effectiveness of your organization related to selected factors:

    Commitment to the group:

    Responsibility of members:

    Effectiveness of communication:

    Previous experience related to paper airplane construction:

LESSON II-5 Word Puzzle

DIRECTIONS: Answer each definition by using the words at the top of the puzzle. The number of words needed for each definition is given in parentheses. Words may be used more than once.

Accident
Emergency
Infraction
Precaution
Regulations
Condition
Equipment
Personal
Procedure
Safety
Documentation
Hazard
Potential
Protective
Unsafe

1. A mishap. (1) ____________________
2. A formal telling of events that occurred. (1) ____________________
3. A course of action to follow in case of an accident. (2) ____________________
4. Care taken beforehand. (1) ____________________
5. Rules or laws which help prevent accidents. (2) ____________________
6. Relating to preventing accidents. (1) ____________________
7. A possibly dangerous situation. (2) ____________________
8. Devices used to keep people from being injured. (3) ____________________
9. A violation of rules or laws which may cause an accident. (2) ____________________
10. A state of being (situation) which may cause an accident. (2) ____________________

LESSON II-5 Word Puzzle Answer Key

1. ACCIDENT
2. DOCUMENTATION
3. EMERGENCY PROCEDURE
4. PRECAUTION
5. SAFETY REGULATIONS
6. SAFETY
7. POTENTIAL HAZARD
8. PERSONAL PROTECTIVE EQUIPMENT
9. SAFETY INFRACTION
10. UNSAFE CONDITION

WHO AM I? QUESTIONNAIRE

Name: ______________________________

Date of birth: ____________________ Age: ________

DIRECTIONS: Complete the following statements or answer the questions based upon your feelings. Since your responses are personal, there are no right or wrong answers. Your responses will not be graded and will be treated in a confidential manner.

1. Today I feel...
2. In general, school is...
3. The thing I like best about this class is...
4. My best friend is ...
5. The things my best friend and I have in common are...
6. The best thing that could happen...
7. Today I would like to...
8. Someday I hope...
9. When I'm proud of myself I...
10. Five adjectives that describe me are...
11. I wish people wouldn't...
12. I like people who...
13. When I finish high school...

14. I spend my time after school...

15. I like to read about...

16. My idea of a good time is...

17. Going to college...

18. People think I...

19. I'm at my best when...

20. Math is...

21. I would like to be...

22. The area where I'd most like to live is...

23. My favorite subject in school is...

24. My favorite hobby is...

25. I'm especially good at...

26. Working outdoors is...

27. Twenty things I like to do:

Adapted from
Canfield, Jack and Harold C. Wells, 100 Ways to Enhance Self-Concept in the Classroom,
Prentice-Hall Inc., 1976

PERSONAL INTEREST INVENTORY

WORK PREFERENCES

DIRECTIONS: Check the items you especially like with a plus (+) and those you especially dislike with a circle (O). If you are undecided, leave the item blank.

1. Work indoors. ______
2. Work where I would sell things. ______
3. Work involving mathematics and science. ______
4. Work where I can be my own boss. ______
5. Work with tools and machines. ______
6. Work with drawings or sketches. ______
7. Work requiring patience and accuracy. ______
8. Work involving people with special physical and/or mental needs. ______
9. Work requiring changes in shifts. ______
10. Work requiring speed. ______
11. Work with other people. ______
12. Work which is clean and neat. ______
13. Work involving original thinking. ______
14. Work directed by someone else. ______
15. Work depending on my writing skill. ______
16. Work which is physical. ______
17. Work where I would meet people. ______

List any jobs you have held, including any you presently hold. Check those you especially liked.

If you had your choice, what kind of job might you like to have?

Adapted from
Lindbeck, John R. and Irvin T. Lathrop, General Industry and Technology
Bennett & McKnight Publishing Company, 1986, page 424

SCHOOL SUBJECTS

DIRECTIONS: Place check marks in the box following the subjects that you like, and in the column that tells how well you do in them.

Subject	Like It	High Grades	Average	Low Grades
1. Science				
2. Mathematics				
3. Social Studies				
4. English				
5. Drafting				
6. Business				
7. Art				
8. Physical Education				
9. Music				
10. Industrial Technology				
11. Foreign Language				
12. Home Economics				

ACTIVITIES

List your clubs, teams, or other school activities.

List your hobbies and recreational activities.

List your out-of-school activities and interest groups.

Adapted from
Lindbeck, John R. and Irvin T. Lathrop, General Industry and Technology
Bennett & McKnight Publishing Company, 1986, page 424

OCCUPATIONAL STUDY REPORT

Name: ______________________________

1. Considering the information you have gathered about your interests, abilities and aspirations, list three occupations that might be appropriate for you.

2. After consulting with your instructor, choose one or more of the occupations listed for additional study. Use a separate form for each occupation. Include the following:

   a. Occupation selected for study:

   b. Main activities of occupation:

   c. Educational and/or special training requirements:

   d. Locations where the greatest opportunities for employment may be found:

   e. Circle the working conditions/personal abilities which apply to this occupation:

quietness
varied activity
noisiness
detailed work
organization
telephone skills
eye strain
punctuality
public speaking

indoor work
outdoor work
mental exertion
repetitiveness
working alone
confidentiality
salaried pay
hourly pay
seasonal work

physical exertion
working weekends
manual dexterity
working with people
working with things
working with animals
working with numbers
working with words
changes in work shifts

danger
working at night
periods of waiting
speed
accuracy
patience
creativity

written communication
arithmetical computation

neatness in appearance
ability to follow directions

ability to read and comprehend technical material

4. Circle the following high school classes which would improve the probability of your success in this occupation. If you have problems with this activity, ask an instructor for help.

Biology
Chemistry
Physics
General Science
Earth Science
Journalism
English Literature
English Composition
Language Arts
Spanish
French
German
Computer Application
Speech
Drama
American History
World History
Sociology
Psychology
Economics
Geography
Civics
Algebra
Geometry
Trigonometry
General Math
Health
Physical Education
General Business
Typing
Bookkeeping
Shorthand
Home Economics
Art
Drawing
Painting
Photography
Music Appreciation
Band
Chorus
Introduction to Technology
Exploration of Technology
Communication Technology
Energy & Power Technology
Materials & Processes Tech.

5. List at least two references where you found information about this occupation.

6. Considering your interests and abilities, list advantages and disadvantages of this occupation.

Advantages

Disadvantages

7. Look through an area newspaper want ad section for job openings in the occupational area you are studying. Staple at least two different ads to this worksheet.

Adapted from form shared by Bill Fuemmeler, Boonville High School.

SAMPLE EMPLOYMENT APPLICATION

SPEEDY TECHNOLOGY ENTERPRISES

FIRST AND MAIN STREETS, ANYWHERE, MISSOURI 00001
000/000-TECH

PERSONAL INFORMATION

(LAST) (FIRST) (MIDDLE)	DATE OF APPLICATION
PRESENT ADDRESS: NUMBER AND STREET	TELE. NO. (INCLUDE AREA CODE)
CITY, STATE AND ZIP CODE	SOCIAL SECURITY NUMBER

ARE YOU BETWEEN THE AGES OF 18 AND 70? YES ___ NO ___ If under 18, applicant will be required to submit a birth certificate or a work certificate as required by the state or federal laws.

IF NOT A CITIZEN, DO YOU HAVE A WORK VISA? YES ___ NO ___

IF YOU HAVE BEEN CONVICTED OF A CRIME OTHER THAN A MINOR TRAFFIC VIOLATION, PLEASE EXPLAIN. Convictions will not necessarily exclude you from employment consideration.

LIST PEOPLE RELATED TO YOU IN ANY WAY WHO ARE EMPLOYED BY THIS COMPANY.

EMPLOYMENT DESIRED

POSITION ________ STARTING DATE ________

ARE YOU EMPLOYED NOW? ________ IF SO MAY WE INQUIRE OF YOUR PRESENT EMPLOYER? ________

EDUCATION	NAME AND LOCATION OF SCHOOL	YEARS ATTENDED	DID YOU GRADUATE?	SUBJECTS STUDIED
ELEMENTARY SCHOOL				
HIGH SCHOOL				
COLLEGE				
TRADE, BUSINESS SCHOOL				

EMPLOYMENT HISTORY (Beginning with present or most recent position.)

COMPANY NAME			POSITION TITLE
ADDRESS			STARTING SALARY FINAL SALARY
STARTING DATE / /	LEAVING DATE / /	REASON FOR LEAVING	SUPERVISOR'S NAME
DUTIES AND RESPONSIBILITIES			
COMPANY NAME			POSITION TITLE
ADDRESS			STARTING SALARY FINAL SALARY
STARTING DATE / /	LEAVING DATE / /	REASON FOR LEAVING	SUPERVISOR'S NAME
DUTIES AND RESPONSIBILITIES			
COMPANY NAME			POSITION TITLE
ADDRESS			STARTING SALARY FINAL SALARY
STARTING DATE / /	LEAVING DATE / /	REASON FOR LEAVING	SUPERVISOR'S NAME
DUTIES AND RESPONSIBILITIES			

PERSONAL REFERENCES (Not former employers or relatives.)

NAME AND OCCUPATION	ADDRESS	PHONE NUMBER

"I Certify that the facts contained in this application are true and complete to the best of my knowledge and understand that, if employed, falsified statements on this application shall be grounds for dismissal. I authorize investigation of all statements contained herein and the references listed above to give you any and all information concerning my previous employment and any pertinent information that they may have, personal or otherwise, and release all parties from all liability for any damage that may result from furnishing same to you.

I understand and agree that, if hired, my employment is for no definite period and may, regardless of the date of payment of my wages and salary, be terminated at any time without any prior notice. Provided state law permits, I further agree to submit to alcohol and/or drug screening tests and polygraph examinations, if requested of me at any time prior to or during my employment."

DATE ____________________ SIGNATURE ____________________

AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITY EMPLOYER

FOR AFFIRMATIVE ACTION PURPOSES

This form will be removed from the Employment Application and retained separately in files used only for Affirmative Action purposes.

The following *is not required* of applicants for employment at Speedy Technology Enterprises; however, *it is requested* in order to determine the effectiveness of the AA/EEO program.

1. Sex: Male ______ Female ______

2. Race: American Indian ______ Black ______ Hispanic ______
Pacific Islander ______ White ______ Other ______

3. Age: ______

4. Citizenship: U.S. Citizen ______ Non-Resident Alien ______
Resident Alien ______

5. Are you a veteran? Yes ______ No ______

   (a) If you are a veteran, are you entitled to disability compensation under the laws administered by the U. S. Veterans Administration for a disability rated at 30 percent or more? Yes ____ No ____

6. The Rehabilitation Act of 1973 requires all applicants be afforded the opportunity to identify themselves as handicapped.

   (a) Do you consider yourself handicapped? Yes ______ No ______

   (b) If yes, what is the nature of your handicap?

____
Signature

____
Position Applied For

LESSON II-7 Word Puzzle

DIRECTIONS: Answer each definition by using the words at the top of the puzzle. The number of words needed for each definition is given in parentheses. Words may be used more than once.

Application
Cluster
Interest

Aptitude
Education
Job

Career
Goal
Training

1. Jobs of varying levels which are related to a particular occupational category. (2) ______________________________
2. The ability to learn. (1) ______________________________
3. A feeling of intensity, concern, or curiosity about something. (1) ______________________________
4. A formal, written request for employment. (2) ______________________________
5. Lifelong study of various aspects of work, career goals, and the sequence of one's occupational interests and choices. (2) ______________________________
6. An ambition or an aspiration toward which one strives or works. (1) ______________________________
7. Obtaining job skill instruction for a specific occupation. (2) ______________________________

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LESSON II-7 Word Puzzle Answer Key

1. CAREER CLUSTER
2. APTITUDE
3. INTEREST
4. JOB APPLICATION
5. CAREER EDUCATION
6. GOAL
7. JOB TRAINING

SAMPLE RECORD KEEPING FORMS

(NAME OF COMPANY)

DAILY TIME LOG*

DATE	EMPLOYEE	TIME IN	TIME OUT	HOURS WORKED

*Actual time clock with individual employee time cards may be used.

BILL OF MATERIALS

Company ______________________ Date ______________
Address ______________________
Telephone ______________________

Quantity	Material Item	Size	Price Per Unit	Total Cost

MONTHLY PAYROLL RECORD

Company ______________________ Date ______________

Pay Period	Salaried Employee	Monthly Salary	Hours	Fringe Benefits	Total

Pay Period	Hourly Employee	Hourly Wage	Hours Worked	Fringe Benefits	Total

HYPOTHETICAL COSTS TO BE DETERMINED BY INSTRUCTOR

1. Total value of company $________________

2. Overhead Cost Factors:

-Management Costs $________________

-Interest Payments $________________

-Utilities $________________

-Taxes

-Local $________________

-State $________________

TOTAL $________________

(COMPANY NAME)

MONITORING RECORD

Product: (name of product) Part Number ____________

Date	Hours Worked	Total Number Units Produced	Units Per Hour	Number Units Defective	% of Units Defective	% of Raw Material Defective/Waste

Product: (name of product) Part Number ____________

Date	Hours Worked	Total Number Units Produced	Units Per Hour	Number Units Defective	% of Units Defective	% of Raw Material Defective/Waste

Finished Product: (name of product)

Date	Hours Worked	Total Number Units Produced	Units Per Hour	Number Units Defective	% of Units Defective	% of Raw Material Defective/Waste

EQUIPMENT INFORMATION

Equipment Item: ______________________________

Equipment Number: ______________________________

Date Purchase: ______________ Purchase Price: $______________

Warranty: ____

Expiration Date: ______________

Vendor: ______________________________
Address: ______________________________
____
____
Telephone: ______________________________
Contact: ______________________________

MAINTENANCE SCHEDULE

EQUIPMENT ITEM: ________________ EQUIPMENT NUMBER: ____________

TYPE OF MAINTENANCE	CYCLE

WORKING MAINTENANCE SCHEDULE

EQUIPMENT ITEM: ________________ EQUIPMENT NUMBER: ____________

DATE	MAINTENANCE	NEXT SCHEDULED MAINTENANCE DATE

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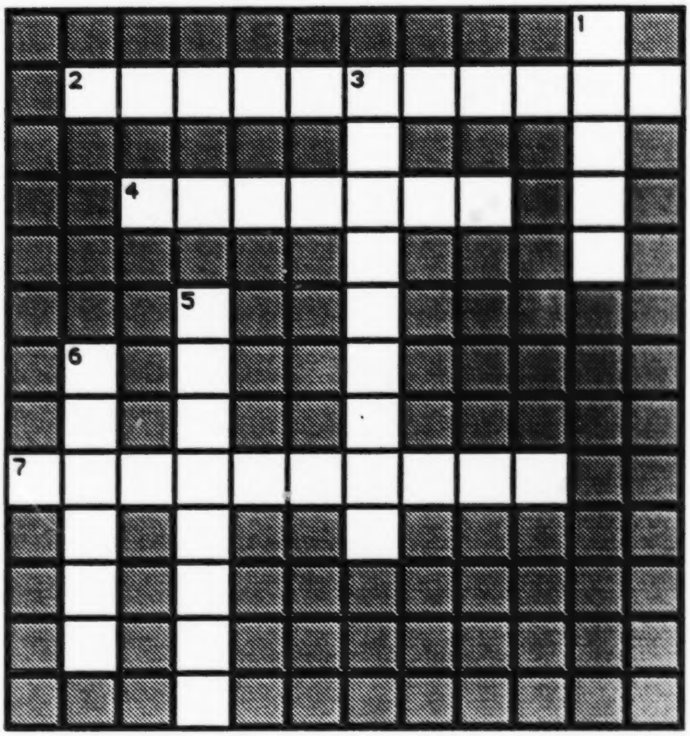
LESSON I-1: VOCABULARY CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle using the vocabulary terms from the lesson indicated. The clues listed below will help you to identify the appropriate vocabulary term.

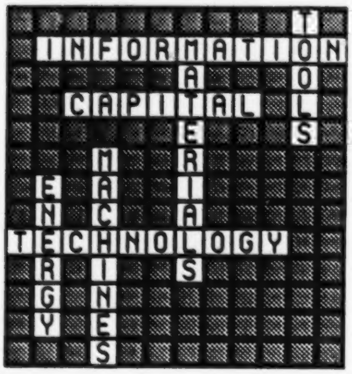


Across

2. Data that have been processed.
4. Money or other forms of wealth used to provide other resources.
7. The use of accumulated knowledge to process resources.

Down

1. These devices extend the natural manual capabilities of people.
3. The physical substances (e.g. wood, oil) that are used in a process.
5. These devices change the amount, speed, or direction of a force.
6. The capacity for doing work.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CAPITAL
Money or other forms of wealth used to provide other resources

ENERGY
The capacity for doing work.

INFORMATION
Data that have been processed.

MACHINES
These devices change the amount, speed, or direction of a force.

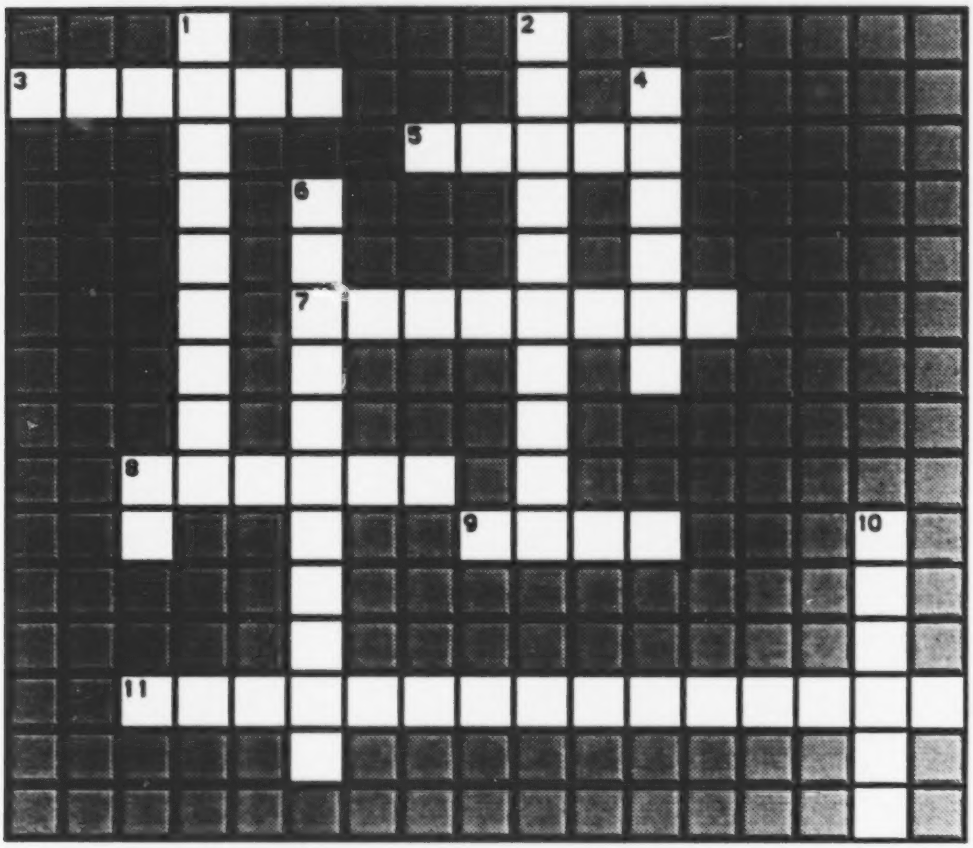
MATERIALS
the physical substances (e.g. wood, oil) that are used in a process.

TECHNOLOGY
The use of accumulated knowledge to process resources.

TOOLS
These devices extend the natural manual capabilities of people.

LESSON II-1: VOCABULARY CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle using the vocabulary terms from the lesson indicated. The clues listed below will help you to identify the appropriate vocabulary term.

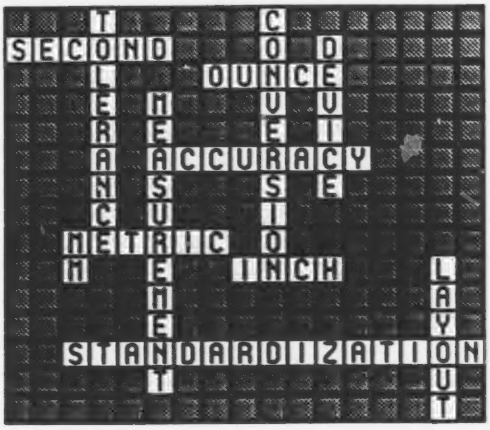


Across

3. 1/60th of a minute.
5. 1/16th of a pound.
7. Exactness.
8. Uses the meter.
9. 1/12th of a foot.
11. Uniform specifications.

Down

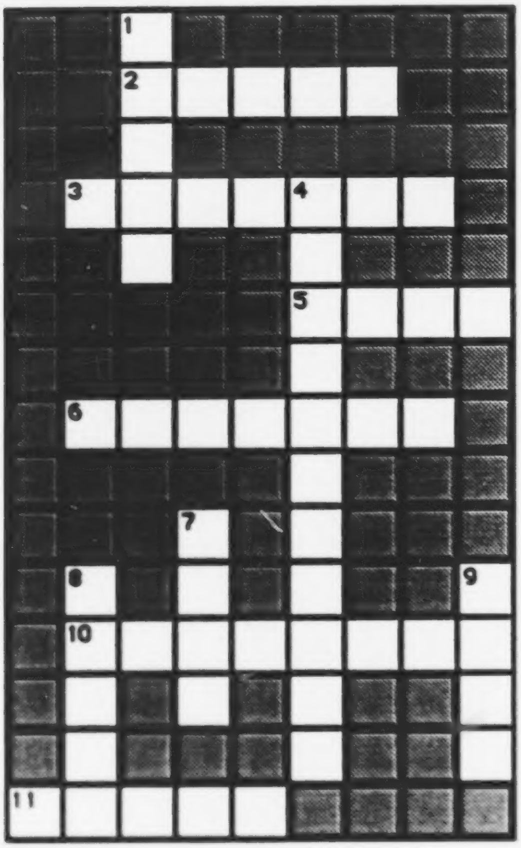
1. Acceptable limits.
2. To change, transform.
4. Special purpose mechanism.
6. Extent, quantity, or size.
8. Symbol for millimeter.
10. Initial preparation.



ACCURACY	Exactness.
CONVERSION	To change, transform.
DEVICE	Special purpose mechanism.
INCH	1/12th of a foot.
LAYOUT	Initial preparation.
METRIC	Uses the meter.
MM	Symbol for millimeter.
OUNCE	1/16th of a pound.
SECOND	1/60th of a minute.
STANDARDIZATION	Uniform specifications.
TOLERANCE	Acceptable limits.
MEASUREMENT	Extent, quantity, or size.

LESSON II-2: VOCABULARY CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle using the vocabulary terms from the lesson indicated. The clues listed below will help you to identify the appropriate vocabulary term.



Across

2. A collection of items in an orderly arrangement.
3. Category of data used in architectural plans.
5. An organized collection of related information.
6. Category of data used for social security numbers.
10. To recover or fetch.
11. A map, diagram, or graph.

Down

1. To place or leave in a location.
4. Data that have been processed.
7. Raw facts and figures.
8. A diagram used to show relative size or importance.
9. Category of data used in textbooks.

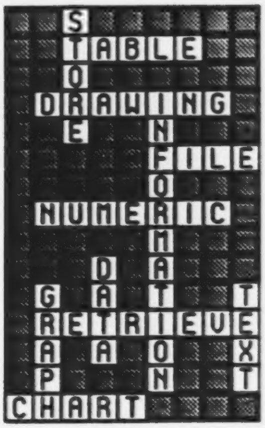

S
TABLE
O
DRAWING
E N
FILE
O
NUMERIC
M
D A
G A T T
RETRIEVE
A A O X
P N T
CHART

CHART	A map, diagram, or graph.
DATA	Raw facts and figures.
DRAWING	Category of data used in architectural plans.
FILE	An organized collection of related information.
GRAPH	A diagram used to show relative size or importance.
INFORMATION	Data that have been processed.
NUMERIC	Category of data used for social security numbers.
RETRIEVE	To recover or fetch.
STORE	To place or leave in a location.
TABLE	A collection of items in an orderly arrangement.
TEXT	Category of data used in textbooks.

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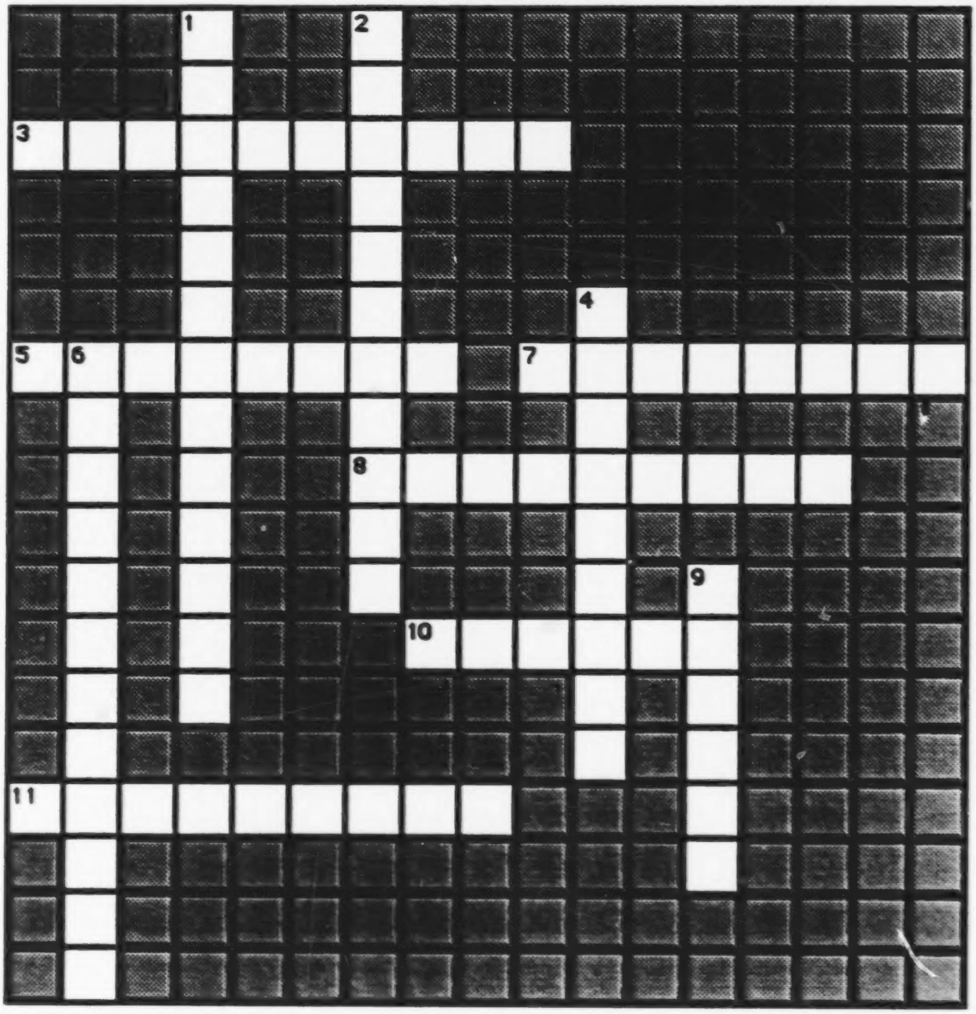
LESSON II-3: VOCABULARY CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle using the vocabulary terms from the lesson indicated. The clues listed below will help you to identify the appropriate vocabulary term.

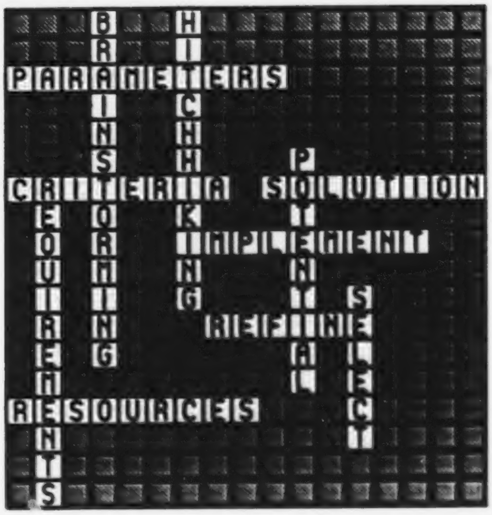


Across

3. Fixed limits or guidelines.
5. A standard on which a decision may be based.
7. An answer to a problem.
8. To carry out or accomplish.
10. To improve or perfect.
11. The things needed to get a job done.

Down

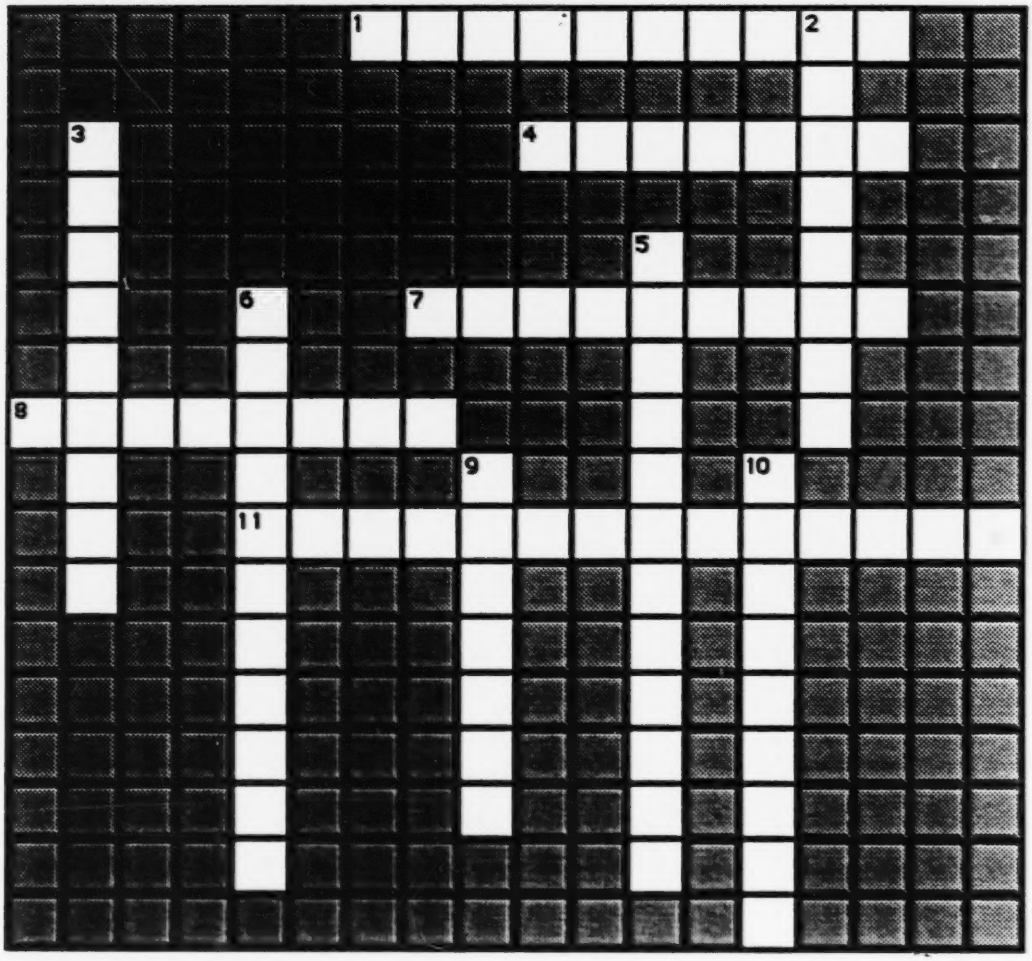
1. Creating as many ideas as possible to solve a problem.
2. To expand on the ideas of others.
4. A possibility.
6. Something needed; necessities.
9. To pick out or choose.



BRAINSTORMING	Creating as many ideas as possible to solve a problem.
CRITERIA	A standard on which a decision may be based.
HITCHHIKING	To expand on the ideas of others.
IMPLEMENT	To carry out or accomplish.
PARAMETERS	Fixed limits or guidelines.
POTENTIAL	A possibility.
REFINE	To improve or perfect.
REQUIREMENTS	Something needed; necessities.
RESOURCES	The things needed to get a job done.
SELECT	To pick out or choose.
SOLUTION	An answer to a problem.

LESSON II-4: VOCABULARY CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle using the vocabulary terms from the lesson indicated. The clues listed below will help you to identify the appropriate vocabulary term.



Across

1. An overseer or superintendent.
4. Having a special ability.
7. The power or right to command.
8. To devise a scheme for making, doing, or arranging something.
11. Involving obligations or duties.

Down

2. A person who works a machine.
3. Having no special ability.
5. To arrange for a common action.
6. Regulating, guiding, or restraining.
9. The head man of a shop.
10. Managing, guiding, or leading.

						S	U	P	E	R	V	I	S	O	R		
														P			
	U								S	K	I	L	L	E	D		
	N													R			
	S										C			A			
	K			C			A	U	T	H	O	R	I	T	Y		
	I			O							O			O			
P	L	A	N	N	I	N	G				R			R			
	L			T				F			D		D				
	E			R	E	S	P	O	N	S	I	B	I	L	I	T	Y
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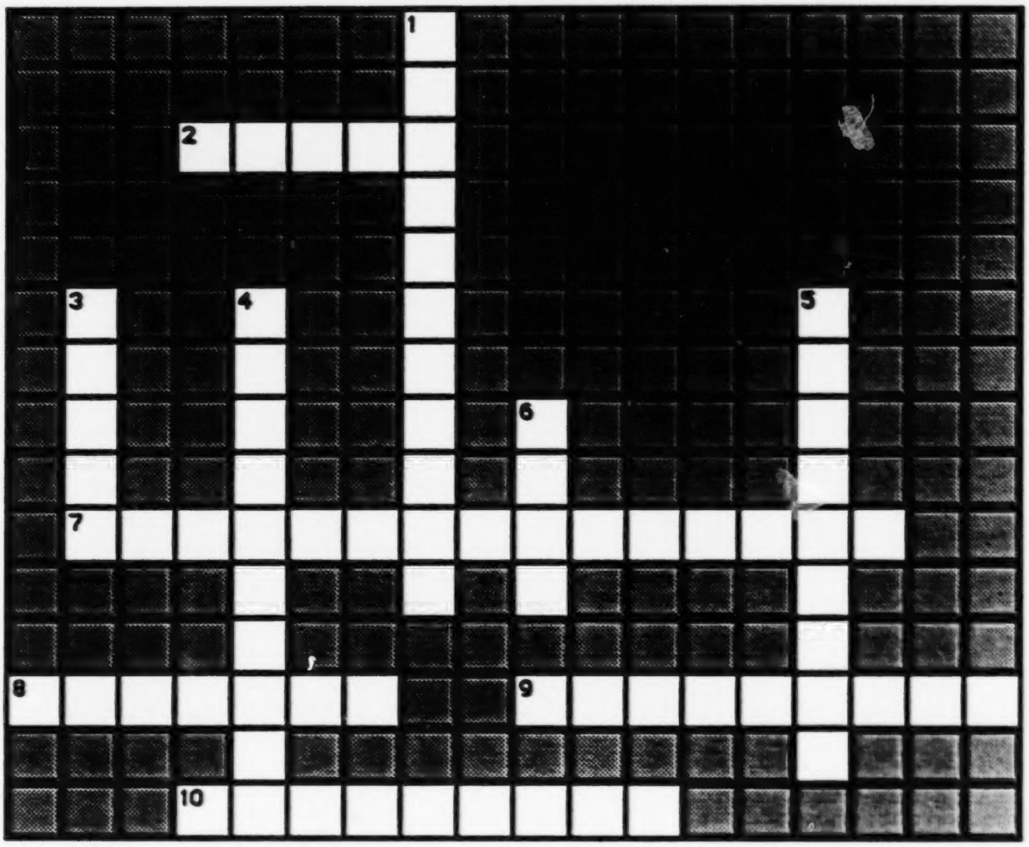
													G				

AUTHORITY
The power or right to command.
CONTROLLING
Regulating, guiding, or restraining.
COORDINATING
To arrange for a common action.
DIRECTING
Managing, guiding, or leading.
FOREMAN
The head man of a shop.
OPERATOR
A person who works a machine.
PLANNING
To devise a scheme for making, doing, or arranging something.
RESPONSIBILITY
Involving obligations or duties.
SKILLED
Having a special ability.
SUPERVISOR
An overseer or superintendent.
UNSKILLED
Having no special ability.

LESSON II-6: VOCABULARY CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle using the vocabulary terms from the lesson indicated. The clues listed below will help you to identify the appropriate vocabulary term.

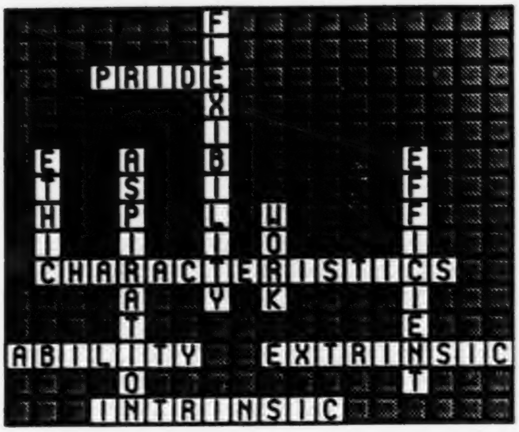


Across

2. A satisfaction in one's achievements.
7. Distinguishing traits, features, or qualities.
8. Possession of enough strength or skill to accomplish a given task.
9. External; Unessential.
10. Inherent; Part of the nature of a person or thing.

Down

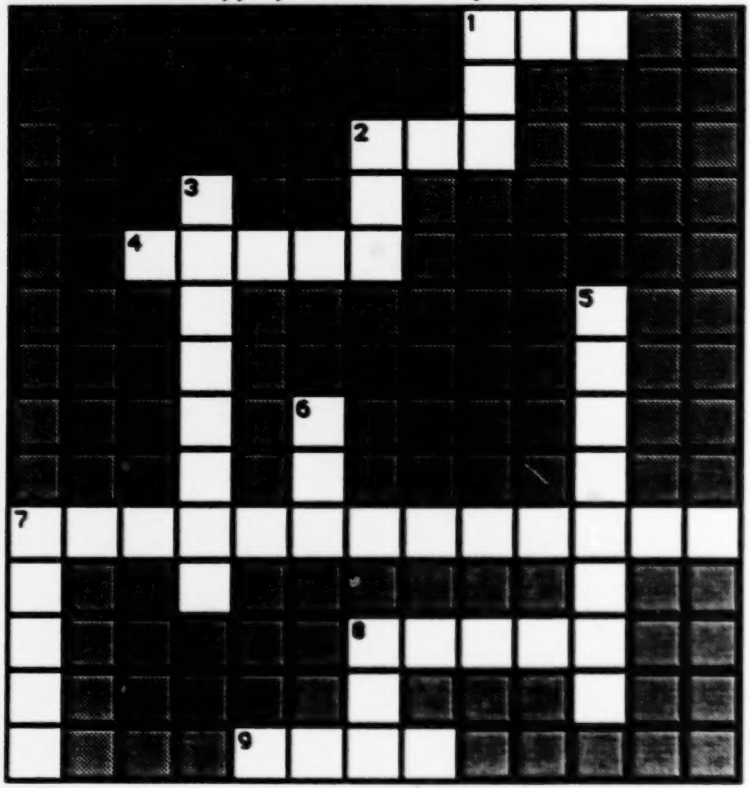
1. Adjustable to change.
3. Standards of conduct.
4. Ambition; Desire for advancement.
5. Producing the desired effect with a minimum of waste.
6. Employment; Doing or making something.


FLEXIBILITY
PRIDE
ETHIC
ASPIRATION
WORK
EFFICIENT
CHARACTERISTICS
ABILITY
EXTRINSIC
INTRINSIC

ABILITY	Possession of enough strength or skill to accomplish a given task.
ASPIRATION	Ambition; Desire for advancement.
CHARACTERISTICS	Distinguishing traits, features, or qualities.
EFFICIENT	Producing the desired effect with a minimum of waste.
ETHIC	Standards of conduct.
EXTRINSIC	External; Unessential.
FLEXIBILITY	Adjustable to change.
INTRINSIC	Inherent; Part of the nature of a person or thing.
PRIDE	A satisfaction in one's achievements.
WORK	Employment; Doing or making something.

LESSON II-8: VOCABULARY CROSSWORD PUZZLE

DIRECTIONS: Complete the crossword puzzle using the vocabulary terms from the lesson indicated. The clues listed below will help you to identify the appropriate vocabulary term.

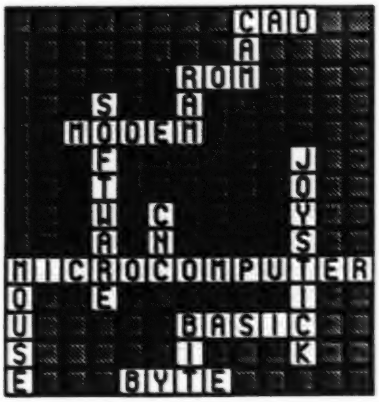


Across

1. Using a computer to assist in the creation or changing of a design.
2. Computer memory which cannot be changed.
4. A device which allows a computer to operate over telephone lines.
7. A small computer with a single integrated circuit microprocessor.
8. A simplified, algebra-like computer programming language.
9. A sequence of adjacent (usually eight) bits.

Down

1. Using computers to control manufacturing operations.
2. Computer memory from which data can be retrieved and altered.
3. A set of programs used to direct the operations of a computer.
5. A lever used to manually change a computer screen display.
6. Using a computer to control the operations of a machine tool.
7. A device which a user moves over the surface of a graphics tablet.
8. The smallest unit of binary information, represents a 0 or a 1.



BASIC
A simplified, algebra-like computer programming language.

BIT
The smallest unit of binary information, represents a 0 or a 1.

BYTE
A sequence of adjacent (usually eight) bits.

CAD
Using a computer to assist in the creation or changing of a design.

CAM
Using computers to control manufacturing operations.

CNC
Using a computer to control the operations of a machine tool.

JOYSTICK
A lever used to manually change a computer screen display.

MICROCOMPUTER
A small computer with a single integrated circuit microprocessor.

MODEM
A device which allows a computer to operate over telephone lines.

MOUSE
A device which a user moves over the surface of a graphics tablet.

RESOURCE CATALOGS/GUIDES

Educators Guide To Free Audio and Video Materials
James L. Berger, Ed.
Educators Progress Service, Inc.
Randolph, WI 53956

Educators Guide To Free Films
John C. Diffor, Ed.
Educators Progress Service, Inc.
Randolph, WI 53956

Educators Guide To Free Filmstrips and Slides
John C. Diffor, Ed.
Educators Progress Service, Inc.
Randolph, WI 53956

CORPORATIONS

Advance Process Supply Company
400 North Nobel Street
Chicago, IL 60622

Allis-Chalmers
Industrial Truck Division
Matteson, IL 60443

American Telephone and Telegraph
Public Relations Office
10 South Canal Street
Chicago, IL 60606

Amoco Teaching Aids - Energy
P.O. Box 1400K
Dayton, OH 45414

APPLESIG
1616 Anderson Road
McLean, VA 22101

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106 Charles Lindberg Boulevard
Uniondale, NY 11533

Black and Decker Corporation
701 East Joppa Road
Towson, MD 21204

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P.O. Box 1354
Waukesha, WI 53187

Career Aids
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Department 1A
Chatsworth, CA 91311

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P.O. Box 1919
Detroit, MI 48288

Coronet Film and Video
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Deerfield, IL 60015

DCA Educational Products Inc.
424 Valley Road
Warrington, PA 18976

Eastman Kodak Company
Educational Markets Services
343 State Street
Rochester, NY 14650

Eaton-Kenway Automated Guided Vehicle Systems
515 East 100 South
Salt Lake City, UT 84102

Epcot Educational Media
500 South Buena Vista Street
Burbank, CA 91521

Firestone Tire and Rubber Company
Department of Public Relations
Akron, OH 44317

Ford Aerospace and Communications Corporation
300 Renaissance Center
Detroit, MI 48243

Fruehauf Corporation
P.O. Box 33238
Detroit, MI 48232

General Dynamics Aerospace Division
Pierre Laclede Center
St. Louis, MO 63105

General Motors Corporation
General Motors Building
Detroit, MI 48202

Georgia Pacific Corporation
900 S.W. Fifth Avenue
Portland, OR 97204

Gould Inc.
10 Gould Center
Rolling Meadows, IL 60008

IBM Corporation
Customer Support Center
One East IBM Plaza
Chicago, IL 60611

IPA Educational Supply
2258 South Campbell
Springfield, MO 65807

Lockheed Missiles and Space Company
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Burbank, CA 91503

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Hampstead Road
London, NW1 7QX

McDonnell Douglas Space Station Programs
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St. Louis, MO 63166

Mead Corporation
Courthouse Plaza N.E.
Dayton, OH 45463

Midwest Conveyer Company
450 East Donovan Road
Kansas City, KA 66115

Motorola Communications and Electronics
Public Relations Office
1309 East Algonquin Road
Schaumberg, IL 60194

National Geographic Educational Services
c/o Karol Media
22 Riverview Drive
Wayne, NJ 07470

National Public Domain Software Center
1533 Avohill Street
Vista, CA 92084

Public Domain Software on File
Facts on File
460 Park Avenue, South
New York, NY 10016

Public Domain, Inc.
5025 South Rangeline Road
West Milton, OH 45383

Radio Shack Educational Comic Book
Program
300 One Tandy Center
Fort Worth, TX 76102

RCA Public Relations Office
30 Rockefeller Plaza
New York, NY 10020

Shell Oil Company
Shell Educational Services
P.O. Box 2463, Room 1541
One Shell Plaza
Houston, TX 77001

Transtech Systems
Division of Creative Learning Systems
9889-E Hilbert Street
San Diego, CA 92131

TRW, Inc.
Defense and Space
23555 Euclid Avenue
Cleveland, OH 44117

Underwriters Laboratory, Inc.
Public Information and Education Services
207 East Ohio Street
Chicago, IL 60611

United States Steel Corporation
208 South LaSalle Street
Chicago, IL 60690

USX Corporation
600 Grant Street
Pittsburgh, PA 15230

GOVERNMENT AGENCIES

Federal Aviation Administration
Office of Public Affairs
Department of Transportation
Washington, DC 20036

Missouri Bureau of Radiological Health
Missouri Department of Health
P.O. Box 570
Jefferson City, MO 65102

National Aeronautics and Space Administration
Lewis Research Center
Office of Education Programs
21000 Brookpark Road
Cleveland, OH 44135

National Aeronautics and Space Administration
Public Relations Department
Washington, DC 20546

National Aeronautics and Space Administration
Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

National Institute of Occupational Safety and Health (NIOSH)
4676 Columbia Parkway
Cincinnati, OH 45226

Occupational Safety and Health Administration (OSHA)
United States Department of Labor
14th Street and Constitution Avenue, N.W.
Washington, DC 20216

U.S. Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

U.S. Department of Transportation
Washington, DC 20591

United States Government Printing Office
Superintendent of Documents
Washington, DC 20402

KEY ASSOCIATIONS

Air Transport Association of America
1000 Connecticut Avenue, N.W.
Washington, DC 20036

American Association for Vocational
Instructional Materials
National Institute for Instructional
Materials
120 Driftmier Engineering Center
Athens, GA 30602

American Coal Foundation
National Coal Association
1130 17th Street, N.W.
Washington, DC 20036

American Gas Association
Educational Services
1515 Wilson Boulevard
Arlington, VA 22209

American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006

American Institute of Timber Construction
333 West Hampden Avenue
Englewood, CO 80110

American Medical Association
535 North Dearborn Street
Chicago, IL 60610

American Petroleum Institute
Information Service Department
2101 L Street, N.W.
Washington, DC 20006

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

American Trucking Association
Education Services
Public Relations Department
1616 P Street, N.W.
Washington, DC 20036

American Vocational Association
2020 N. 14th Street
Arlington, VA 22201

American Wind Energy Association
1621 Connecticut Avenue, N.W.
Washington, DC 20009

American Wood Preservers Institute
Attn: Visual Aids
1651 Old Meadow Road
McLean, VA 22101

Apple Computer Clubs
5000 Park Street
St. Petersburg, FL 33709

Association of American Railroads
Office of Information and Public Affairs
1920 L Street, N.W.
Washington, DC 20036

Atomic Industrial Forum
Public Relations Department
7101 Wisconsin Avenue
Bethesda, MD 20014

Energy and Education Action Center
Room 514, Reporters Building
300 7th Street, S.W.
Washington, DC 20202

Graphic Arts Technical Foundation
4615 Forbes Avenue
Pittsburg, PA 15213

Industrial Technology Education Association
1914 Association Drive
Reston, VA 22091

Institute of Electrical and Electronics
Engineers
345 East 47th Street
New York, NY 10017

National Aerospace Education Council
310 Shoreham Building
806 15th Street, N.W.
Washington, DC 20005

National Association of Manufacturers
1331 Pennsylvania Avenue, N.W.
Suite 1500 N.
Washington, DC 20004

National Association of Rocketry
182 Madison Drive
Elizabeth, PA

National Electrical Manufacturers Association
2110 East 24th Street
Brooklyn, NY 11229

National Energy Foundation
5160 Wiley Post Way
Salt Lake City, UT 84116

National Petroleum Council
Director of Information
1625 K Street, N.W.
Washington, DC 20006

National Safety Council
Traffic and Transportation Safety Materials
Catalog
Traffic Safety Department
444 N. Michigan Avenue
Chicago, IL 60611

National Science Teachers Association
1724 Connecticut Avenue, N.W.
Washington, DC 20036

National Solar Heating and Cooling
Information Center
P.O. Box 1607
Rockville, MD 20850

Society of Manufacturing Engineers
SME Video Communication
P.O. Box 930
One SME Drive
Dearborn, MI 48121

Society of Plastic Engineers
Education Chairman
2010 Harvey Road
Wilmington, DL 19810

The National Center for Research in
Vocational Education
The Ohio State University
1960 Kenny Road
Columbus, OH 43210

Thomas Alva Edison Foundation
Cambridge Office Plaza
Suite 143, 18280 W. Ten Mile Road
Southfield, MI 48075

Vocational Instructional Services
F. E. Box 182
Texas A&M University
College Station, TX 77843

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Wright, R. Thomas. Exploring Manufacturing with Student Manual and Instructor's Guide. Goodheart-Willcox, 1985.

Wright, R. Thomas. Processes of Manufacturing with Instructor's Guide. Goodheart-Willcox, 1987.